FORESTRY ABSTRACTS

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THE BENDING OF WOOD*

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THE practice of wood bending dates back to the dawn of history when man first began to utilize the products of the forests. Primitive coracles, baskets, bows, etc., are examples of the manner in which the bending properties of wood were made to serve man's needs at a very early date and, as might be expected, these examples are of wood bent in more or less its natural state, without receiving any special treatment for improving its bending qualities.

Since wood in its natural state has strongly marked elastic properties which render it resilient, bends made from such material would retain their full shape only so long as they were securely held in place by adjacent members of a structure. When, as time advanced, thick material curved to a small radius was required for, say, shipbuilding, it was necessary either to improve upon the existing process of bending, or to cut and fashion the wood to the curved shape required. To this day, some curved boat members are fashioned from limbs of trees having a curvature roughly the same as that required, and the bandsawing of certain curved parts is still common practice.

The former of these two methods of producing shaped boat-building material has obvious limitations and often there are distinct disadvantages connected with the bandsawing method. In the first place, when bandsawing a curved piece of comparatively small radius of curvature, it becomes necessary to saw some portion of it across the grain of the wood, with consequent appreciable reduction in the strength of the piece as a whole. Secondly, the awkwardly shaped portions that are cut away often constitute a very serious conversion loss.

Softening for Bending.

The first great improvement in the technique and possibilities of wood bending took place when it was discovered that the bending properties of certain woods could be very appreciably enhanced by subjecting them to heat treatments in the presence of moisture. Hardwoods such as Beech, Oak and Ash, when subjected to steam, immersed in boiling water, or even heated over a fire, may be bent more readily and to a smaller radius of curvature without fracturing, than can similar untreated material. The effect of such a treatment is to render these woods plastic, but only in the sense that the fibres may be compressed considerably in excess of the amount that they could be in the cold state without rupture occurring. The breaking strain, or maximum permissible stretch of the fibres, however, is increased but slightly as a result of heat treatments, and this fact has an important bearing on wood bending technique generally.

Tests have shown that a good bending wood such as Beech may, after a suitable heat treatment, be compressed some 30 per cent. of its original length before exhibiting signs of failure, whereas, in the cold untreated state, failures would tend to occur when the compressive strain amounted to about 0·5 per cent. On the other hand, in whatever way the timber is treated, tension fractures are liable to occur when the stretch of the fibres amounts at the most to about 2 per cent. of their initial length.

In the bending of any straight piece of timber, the ends tend to remain square with the faces, so that in the bent state there is a difference in the overall lengths of the convex and concave faces which initially were equal. This difference is brought about by compressing the fibres along the concave face and stretching those on the convex.

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Any heat treatment, therefore, that softens and increases the compressibility of a wood will improve its bending properties, making it possible to attain a smaller radius of curvature with a given thickness of piece. The limit will be reached when the fibres on the convex face have been stretched to their maximum value of around 2 per cent., at which point fracturing along this face will occur. In

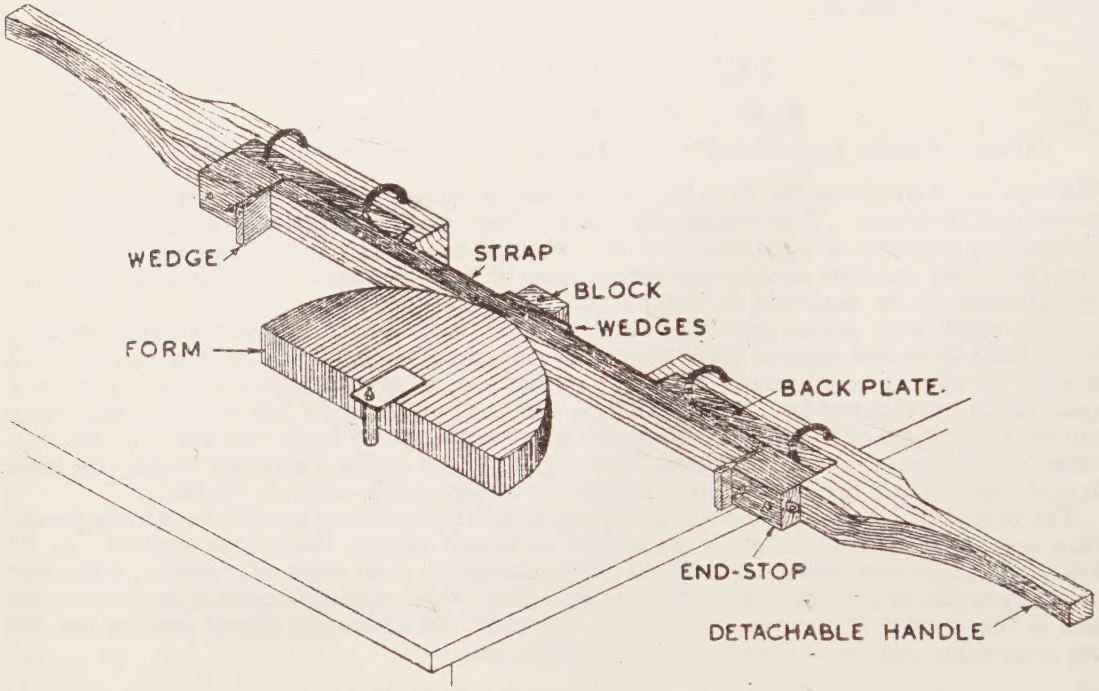

FIG. 1. INITIAL SET-UP FOR MAKING A SIMPLE U-SHAPED BEND.

good bending species, this point is reached long before the fibres on the concave face have become compressed to their full limit and the piece may therefore be bent to a still smaller radius if the stretch of fibres on the other face can be limited by mechanical means. In common bending practice, this result is obtained by supporting the stretched face with an inextensible steel strap which is secured by means of blocks or 'end-stops' to the ends of the piece to be bent (Fig. 1). The effect of steaming on the bending properties of certain species and the improvement obtained by the addition of such a strap may be seen from the limiting radius values given in the table below.

APPROXIMATE RADIUS OF CURVATURE (IN INCHES) AT WHICH BREAKAGES IN BENDING 1 IN. THICK, AIR-DRIED MATERIAL SHOULD NOT EXCEED 5 PER CENT.

Species	*Untreated*	*When supporting straps*	
		are used (steamed)	*are not used (steamed)*
Ash, European (*Fraxinus excelsior*) (home-grown).	Very approximately 50	2·5	12·0
Beech, European (*Fagus sylvatica*) (home-grown).	—	1·5	13·0
Oak, European (*Quercus robur*) (home-grown).	—	2·0	13·0
Teak (*Tectona grandis*).	—	16·0	28·0

It will be observed that whereas Ash, Beech and Oak react very favourably to softening treatments, Teak, like most other tropical hardwoods, is refractory in this respect.

From tests carried out at the Forest Products Research Laboratory, Princes Risborough, it has been established that wood is in the most suitable state for bending when it is air-dried to a moisture content of about 25 per cent., and heated throughout, preferably by steam, to a temperature of 100° C.

As stated above, softening can be induced by almost any form of heat treatment that does not at the same time overdry the wood as, for example, boiling treatments for softening spade handles, hot-sand or gas-jet heating for walking sticks, and the open-fire heat treatment sometimes used for softening barrel staves. Chemical softening treatments have been tried from time to time, but; so far as is known to the writer, with little success.

Bending Technique for Solid Wood.

Hand Bending.

In modern bending practice, many curved parts are produced manually without the aid of power-driven machines, and this applies particularly to the production of complicated shapes. Success often depends as much, or more, upon the skill and experience of the operators as upon their knowledge of the underlying principles of the process. In the past, there has been a tendency somewhat to over-emphasize the significance of skill and experience and for firms to be rather reticent on the subject of bending in general. This possibly accounts for the fact that very little has been written and published on the subject generally, apart from a few articles and leaflets issued by the Forest Products Research Laboratory.

The bending of cold or steamed, but unsupported, wood around a framework, as is done for instance in shipbuilding, presents no unusual problems, provided the curvature is such as the unsupported wood will tolerate. Considerable ingenuity, however, may be shown in the actual manipulation and assembly.

When, however, the curvature is such that fractures can be avoided only by supporting the fibres with a steep strap, difficulties increase, and usually it is found that such failures as occur are attributable to faulty end-connexions of wood to metal. The need for providing the strap with strong, secure end-attachments or end-stops may better be appreciated by stating that in bending 3-in. × 1½-in. Beech to a radius of 8 in. around an angle of 180°, the measured thrust on the end-stops was about 5,000 lb.

End-stops commonly used are made of wood or metal and may be either fixed or adjustable. If fixed, it is often necessary to make the strap taut initially by inserting wooden wedges between them and the ends of the specimen.

The straps for hand bending should be provided with extended handles to afford leverage, and should also be fitted with back-plates of wood or metal extending some distance along the back of the strap and so behind the specimen to be bent (Fig. 1). Without these plates, the heavy forces transmitted by the wood to the strap would tend to cause the stops to swivel and the wood may even free itself from the strap. In addition, these plates tend to minimize the normal tendency during bending for the as yet unbent but compressed portion of wood near the ends to buckle inwards in the manner of a loaded strut or, as it is termed, to 'backbend'.

This backbending tendency becomes particularly marked when the section of the piece is small as compared with the length, and here an adjustable end-stop that permits a limited and controlled amount of stretch to occur often proves essential. Clamping at intermediate distances may be resorted to in cases of severe backbending, such as are likely to occur, for example, in the production of the complicated hairpin-shaped back and legs for the well-known Austrian type of bentwood chair.

Success in the bending operation will, of course, be seriously jeopardized if defects such as knots or splits are present in the material, as these provide planes of weakness that are liable to cause breakdown with a tearing apart of the fibres as compressive loads are applied. The influence of defects becomes less marked if these are situated near the neutral axis (i.e. that part of the specimen that, in bending, is under neither tension nor compression), which is in the vicinity of the convex face. Fungus in timber usually renders it so brittle as to make it useless for any form of bending.

On completion of a successful bend of the simple **U**-type, a metal tie-bar is usually fitted across the bend from one end-stop to the other, or wooden strips may in some cases be nailed across the ends of the bent pieces to secure and hold them until they are 'set'. More complicated shapes that cannot easily be secured in this manner are usually clamped securely to the forms, where they remain until the setting process is complete.

Machine Bending.

In whatever manner wood is bent, the principles underlying the process remain the same, but by the use of machinery, as distinct from the comparatively simple hand-bending equipment, a large number of bends may often be made in one operation, and the bending of large-dimensioned stock greatly facilitated. Probably the simplest form of bending machine consists of a hand- or power-driven winch linked by means of ropes or chains to the ends of the bending straps. These ropes, which pass around suitably placed guide pulleys, can be made to pull the end-stops forward and towards one another, when the winch is operated, in such a manner that the wood is caused to wrap tightly round the appropriate form or jig.

Most of the modern bending machines of the so-called lever-arm type are essentially the same as that referred to above, except that they are provided with stout metal levers or arms by means of which the forces are transmitted to the wood-strap system. These arms, which in effect correspond with the handles and back-plates used in hand bending, are normally linked together by a strong metal strap commonly referred to as the major strap. In addition to the major strap, strong adjustable end-stop fittings are attached, one to each arm, and arrangements made for these to be clamped in several positions along the lengths of the arms so that the distances apart may correspond with the lengths of the pieces to be bent. The bending forces are transmitted to the arms either by means of chains or ropes, or through a rack and pinion mechanism as in the type of machine illustrated in Fig. 2. For the initial set-up, the wood is usually fitted into a comparatively light minor strap which has metal angles or plates secured to its ends, and which is placed snugly in position between the two strong major end-stops. With the form fixed in its appropriate position, it is only necessary to set the machine in motion for the arms, wood, and straps to be pulled upwards and around the form and hence for the wood to become bent to the shape required.

The wood can be held to shape, until set, by fitting a tie-bar or hook across the ends of the minor strap, and, when the major strap has been freed by manipulation of the adjusting screws on the end-stops, this strap and the two lever arms can be returned once more to the horizontal position ready for the next bend.

Machines of this type are not suitable for producing continuous-type bends such as hoops or ring seats for certain designs of bentwood chairs. For bends of this character, a machine is usually employed in which is incorporated a rotatable table or disc. The circular form, usually made of metal, is attached to this table, and one end of the steel strap and of the wood are attached to a point on, or near, this form. Normally, a spring-loaded roller is brought to bear upon the back of the wood and strap at the point of contact with the form. To this roller would be attached a long metal slide or feed arm, along which the unbent portion of the wood, and the end-stop fitted to the strap at the end remote from the form, are constrained to move. When the table is revolved, the wood and strap are automatically wrapped round the form and kept in close contact by the pressure exerted radially by the roller. In some models, the wood is wound helically so that when it is bent through an angle of 360° the two end-stops may pass each other without fouling. In other makes the form is shaped so as to cause the wood to bend as a tight-spiral for the same reason.

It is not customary in a machine of this type to have both a major and a minor strap, but the sliding end-stop is usually detachable and, incidentally, adjustable, so that after clamping the end of the wood and strap together when the circle is complete, this end-stop can be freed from the wood. Automatic stretch control is often provided so that the tendency of the wood to back-bend is minimized so far as is possible without fracturing. On completion of the bending operation, the form, wood, and strap are removed for setting, and a new form and strap provided for the next bend.

Setting.

Steamed wood is neither perfectly plastic nor elastic, and, when bent, will contain residual stresses that will tend to cause the bend to open out and flatten unless held in restraint. It has been explained

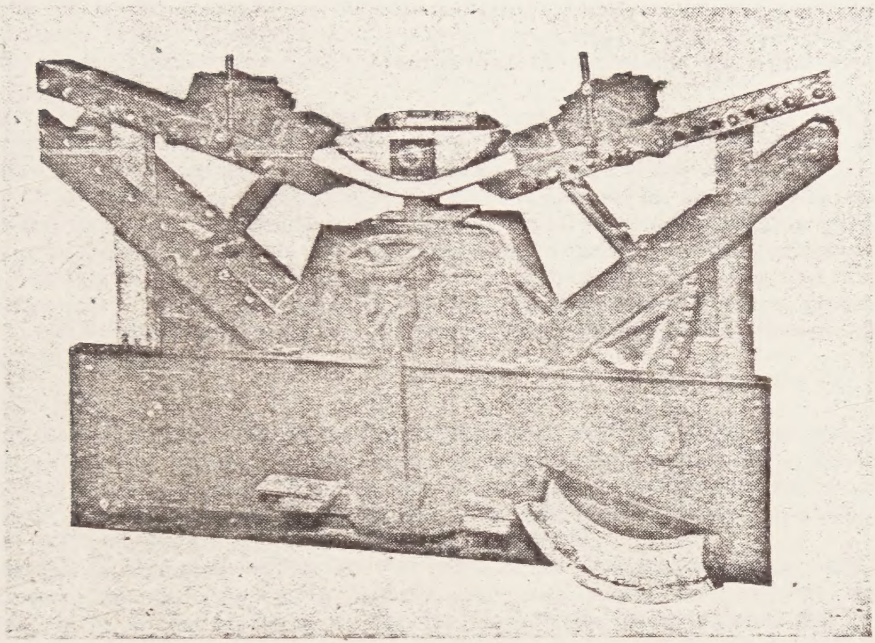

FIG. 2. LEVER-ARM BENDING MACHINE OPERATED BY A RACK AND PINION MECHANISM.
[By courtesy of William Birch & Sons, Ltd.]

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how bends are held to shape temporarily by means of tie-bars or clamps, but it is obvious that such restraint cannot be maintained indefinitely, and some treatment must be employed for setting the bends rigidly to shape.

Setting can be accomplished most readily by removing some of the moisture and then cooling the bent piece. This process may in some respects be considered as a reversal of the softening treatment. The setting process may be accelerated by subjecting the bent wood to hot dry air, and often temperatures as high as 150° to 160° F. can be used without damaging the timber. During the setting process, a bend must always be held to shape and, if of a severe character, the strap should be left on it for part, if not the whole, of the setting period, so as to minimize the risk of stretch and fractures occurring during this treatment.

A bend may become 'set', i.e. rigid, when the moisture content of the piece is still fairly high, but, ideally, it ought not to be incorporated in the finished product before it has been dried to the appropriate moisture content in service, which, say for indoor furniture in this country, would be about 12 per cent. It is interesting to note that any bend that has become 'set' and rigid will tend to open out and flatten if steamed or immersed in water, and also that it will react to moisture changes. An increase in moisture content invariably tends to cause a bend to open out, whereas, unless the previous wetting has been excessive, a subsequent drying will cause the piece to move in, and the radius of curvature to decrease. For this and other reasons, it is virtually impossible to secure great accuracy of shape with either solid or laminated bending though, for practical purposes, the inaccuracies are usually of small moment.

Laminated Bending.

All timbers can be bent to a certain extent in the cold state, as already mentioned, and, if cut into very thin strips, they may be bent to a small radius of curvature without fracturing. By assembling a number of such strips or laminae in the manner of cards in a pack, with glue between the layers, it is possible to bend quite easily a thick assembly to a small radius of curvature which, when the glue has set, will constitute a rigid, thick, laminated member.

The advantages of laminated bending are that bends of severe character may be made from any species of timber, and even poor-quality material, quite unsuitable for solid bending, may within reason be used; if the laminae are sliced or rotary cut, considerable saving in timber may be effected; long lengths obtained fairly readily by scarf-jointing laminae end to end may be utilized; and bends can be set more readily and made to conform better to the shape of the jig than similar bends of solid material. As might be expected, however, financial, technical, and other considerations must be taken into account before deciding upon the best method to employ in particular circumstances.

Almost any glue may be used in the production of laminated bends, though where it is required to be moisture-resistant as, for example, in aircraft constructional work, a urea-formaldehyde or phenolic-type glue is usually specified. In whatever manner the laminated assembly is bent, it will be necessary to apply radial pressure across the glue lines, not only to hold the assembly to shape while the glue is setting, but also to ensure firm and proper bonding of the adhesive. A very common method of achieving this is to press assemblies into shape between suitably curved male and female forms, though the female form sometimes appears as a metal tension band, or as a pressure pad and series of pressure wedges, as illustrated in Fig. 3. Another method is to apply radial pressure by means of inflated or deflated rubber hose or bags, in which case a uniform fluid pressure is exerted over the whole bend. The pressure bag, for example, may be attached to, or may constitute the male form, and may be inflated with air so as to force the laminae to shape and maintain a pressure until the glue becomes set. Conversely, the male form, with laminae in position, may be placed inside a rubber bag which is sealed and deflated by means of a vacuum pump.

Continuous bends, such as may be used for hoops, ring seats, etc., cannot readily be made by the above methods, and recently the Forest Products Research Laboratory developed a method known as the continuous-strip method for producing laminated bends of this kind. This method consists in first joining end-to-end, by means of scarf joints, a number of laminae of uniform width and thickness to form one long strip, which can then be wrapped around a spider or drum ready for feeding on to the bending form. This form is mounted on a rotatable table, and one end of the strips is attached to it. When the table is revolved, the form is caused to rotate, and the strip is wrapped around it in spiral

form, while at the same time, glue is spread on to the strip by means of a glue spreader suitably placed to contact the straight portion feeding into the form. The all-important radial pressure applied across the glued surfaces is obtained either by means of a pressure roller, or by means of a tensioned belt, which throughout the bending operation embraces the wood and form in the manner of a hand-brake. The completed bend needs to be clamped to the form and so held until the glue has set.

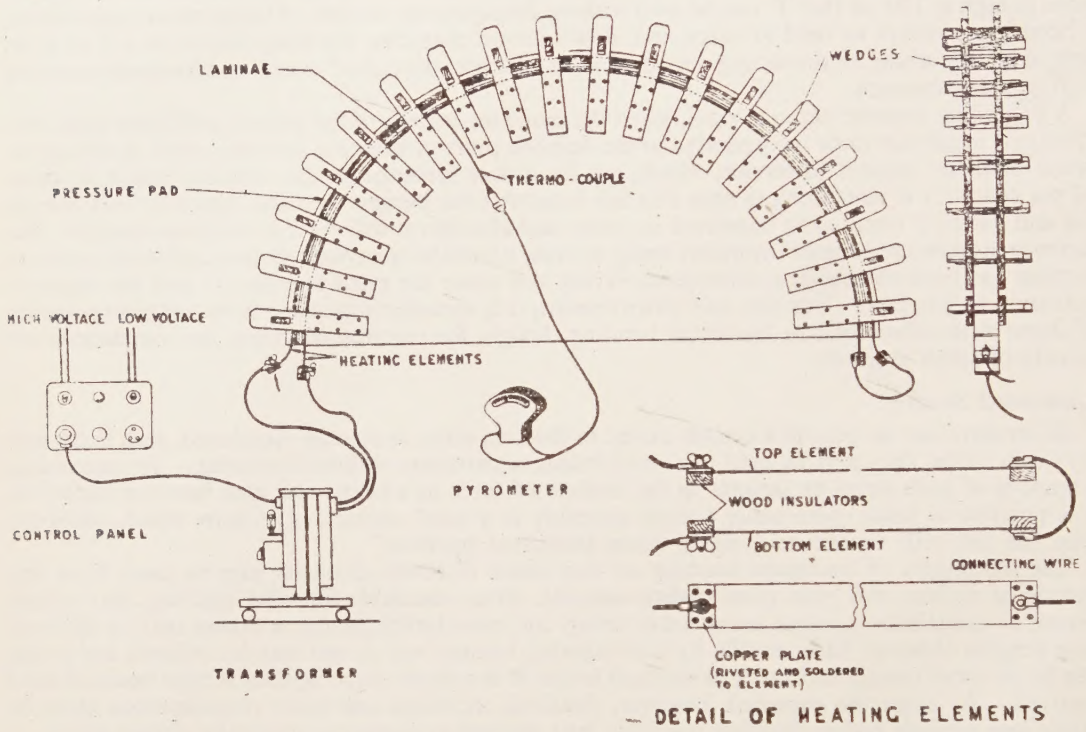

FIG. 3. SETTING OF LAMINATED BENDS BY THE LOW VOLTAGE STRIP HEATING METHOD.

Glue Setting.

The setting to shape of laminated bends is essentially a process of glue setting, and the method used will, therefore, depend to a large extent upon the type of glue used. Unlike the animal and vegetable glues, the modern casein and synthetic resins become set by virtue of chemical changes taking place in the adhesive as well as by the loss of moisture, and both these effects can be accelerated by increased temperatures. By the quick setting of these glues at high temperatures, not only can the rate of production be increased, but also the number of bending jigs required can be kept to a minimum.

Heat, to accelerate the setting of the glue, can be applied to the laminated component in a variety of ways, such as moving the assembly into a heated room, heating the jig by means of steam, hot water, electricity, etc. Another method is to incorporate electrically heated blankets or low voltage strips in the system.

The low-voltage strip-heating process, which was developed for use in the mass production of laminated bends for wooden aircraft during the second world war, has proved to be one of the most convenient methods of applying heat to glue layers. The heating elements usually consist of steel strips carrying a low-tension current of high amperage. A typical set-up of jig, heating elements, etc., for the production and quick setting of a semi-circular laminated bend is shown in Fig. 3. The metal strips, which are in contact with the two faces of the bend, are joined together at one end and,

at the other, are connected to a step-down transformer. The resistance which the strips offer to a current passing through them causes heat to be generated, which is conducted through the wood laminae to the glue layers. Temperature control is usually obtained by regulating the current flowing through the strips, and measurements are made by thermocouples in the glue lines. Troubles may be experienced if the temperature is allowed to rise to 100° C. and the moisture in the glue to boil.

During recent years, other methods of heating glue layers have been developed, but these are, for the most part, either still in the experimental stage or have proved to be somewhat costly. Examples of these are heating by infra-red rays, by radio-frequency power, or by the passage of an electric current through wires or gauges embedded in the glue layers. Probably the most promising of these is the electrostatic process in which the glued laminae are placed in an electric field which oscillates at high frequency and results in heating occurring uniformly throughout the mass. This method appears to be especially well adapted to the gluing of thick laminated members, such as laminated roof trusses, stems for boats, etc., where other methods are time-consuming or impracticable. The process, however, is still in the developmental stage, and much work remains to be done.

ABSTRACT SECTION

NOTE.– A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]— German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

02. COMPENDIA. DICTIONARIES. LISTS OF VERNACULAR NAMES

See also *For. Abstr.* 9 (Nos. 1583, 1585).

[1397]. 02.2 (44). Vade-mecum du forestier. [**Forester's pocket-book.**] Société forestière de Franche-Comté. 3rd. ed., 1946. pp. 285. [F.] Price 125 francs [10/-].

[1398]. 02.41 (437) : 09.1. SVOBODA, P. Lidové názvy dřevin a význam místních názvů pro lesnickou dendrologii a geobotaniku. [**The popular names of trees and the significance of local names in forest dendrology and plant geography.**] *Lesn. Práce* 26 (7/9), 1947 (258–86). [Cz.russ.]

Contains an extensive list of Czechoslovakian popular and dialect names of trees and shrubs, and various designations connected with former methods of forest exploitation, many of which survive only in place names. These often have a use as a guide to the past history of the countryside, besides indicating the former range of species and their utilization.

03. OTHER SELF-CONTAINED GENERAL WORKS

[1399]. 03 (410). EDLIN, H. L. **Forestry and woodland life.** B. N. Batsford, Ltd., 15 North Audley Street, W.1. 1947. pp. viii + 184 + plates. Price 15*s.* 0*d.*

This book is planned as an outline for the layman, and as a summary for those concerned with forest work, of the science and craft of tending woodlands as at present practised in Britain. The first 11 chapters are devoted to the natural growth of trees and the influence of soil, climate, and wild plants and creatures of all kinds upon the life of the forest. The remaining 13 chapters deal with man's influence on the forest. The accounts of work in the forest are intended to make clear the normal course of events in the treatment of an average wood. *From author's preface.*

[1400]. 03 (410). GURNEY, R. **Our trees and woodlands.** The Medici Society, Ltd., Pentonville Road, London, N.1. 1947. pp. xvi + 144 + 10 plates. Price 8*s.* 6*d.*

An introduction for the general reader to the history, economy, culture and biology of the woodlands of Britain, illustrated with the author's own drawings. The book contains a glossary of terms used, a bibliography of 100 references and an index.

04. TABLES. FILMS

[1401]. 04.3. LARSON, E. H. **Tables for technical writers.** *Sta. Pap. Ntheast. For. Exp. Sta.* No. 3, 1947. pp. 47.

The purpose of this paper is to show as simply as possible the main principles of tabular presentation of data, including the fitting of the table into the text.

[1402]. 04.6 (711). **Motion picture films : a catalog of the educational films available from B.C. Forest Service.** British Columbia Forest Service, Victoria, B.C. 1947. pp. 15.

The British Columbia Forest Service maintains a small library of films, listed in this catalogue, for loan, without charge, to the public. Films are mostly 16 mm. in width. The primary purpose of the library is to interest the public in the importance and value of the forest resource and the vital necessity of protecting and conserving it. A number of films on other topics (news, sport, natural history, comedies, etc.) are included in the library, to enable the borrower to put on a programme of interest to all classes and ages.

07. EDUCATION AND RESEARCH. COLLECTIONS

[1403]. 07.1 (669) : 81. COLLIER, F. S., and KEAY, R. W. J. **Regional training of forest staff in Nigeria.** Forest Department, Nigeria. 1947. pp. 5. (Fifth British Empire Forestry Conference, Great Britain, 1947.)

[1404]. 07.2 (71). CAMERON, D. R. **Forest and forest products research in Canada.** *Unasylva* 1 (1), 1947 (47–52).

An outline of the organization of forestry research in Canada, the progress hitherto made and the programmes for future work, along the lines of silviculture, protection, aerial surveys, and forest products research.

[1405]. 07.5 (7). WYMAN, D. **The arboretums and botanical gardens of North America.** *Chron. Bot.* 10 (5/6), 1947 (395–498 + plates). Price $1.50.

Notes on the establishment and maintenance of botanical gardens and arboretums, a detailed list of those of North America, and lists of small collections of special plants; 43 plates.

09.2. *Pre-history. Pollen Analyses, etc.*

[1406]. 09.2 (44). DUBOIS, G., and DUBOIS, C. • Tableau d'ensemble de l'histoire forestière flandrienne française. **[General picture of the forest history of France in the last glacial and post-glacial periods.]** *C.R Acad. Sci., Paris* 221 (21), 1945 (634–6). [F.] D.S.I.R.

[1407]. 09.2 (7). PENNY, S. **Study on the conifers of the Magothy flora.** *Amer. J. Bot.* 34 (5), 1947 (281–96). O.B.D.

09.4. *Forest Statistics*

See also *For. Abstr.* 9 (Nos. 1962, 1966, 1968).

[1408]. 09.4 (471). KRAEMER, J. H. **Forest resources and lumber industry of Finland.** *J. For.* 45 (9), 1947 (649–54).

[1409]. 09.4 (478) : 98.1 : 32.92–4. SOSHNIKOV, M. Reshenie problemȳ lesozagotovok v basseyne Kamȳ v IV pyatiletii. **[Solution of exploitation problems in the Kama basin under the fourth Five-Year Plan.]** *Lesnaya Prom.* 1947 (3), (3–7). [Russ.]

With a view to more intensive exploitation of the forest resources of the Kama river system [cf. *For. Abstr.* 7 (No. 502)] and of forests situated further north, it is proposed to improve floating and rafting facilities on the Volga, the Volga-Don canal, and the canals linking the Kama, Pechora and Vychegda rivers, thus facilitating water transport of timber from north to south and opening up vast quantities of overmature forest. The present article includes statistics of forest areas, location and volume of exploitable timber, and suggested periods for its removal, arranged by provinces. The erection of woodworking factories within the region, in localities with sufficient hardwood stands, is envisaged as a means of utilizing the species that would be difficult or impossible to float out.

[1410]. 09.4 (485). KRAEMER, J. H. **Forest resources and lumber industry of Sweden.** *J. For.* 45 (8), 1947 (565–9).

[1411]. 09.4 (492). De Nederlandsche boschstatistiek. **[Forestry statistics of the Netherlands.]** Ministerie van Landbouw, Visscherij en Voedselvoorziening. 1946. pp. 24 + plate. [Du.du.e.] F.C.A.H.

Data for statistics of the Netherlands forests, based on aerial photography and checked by field survey, were collected from 1939 to 1942. They include a classification of land by use and by ownership, and distribution by species in 2 age classes, all tabulated. Forest maps, scale 1 : 25,000, were also made. It is proposed to check the statistical data periodically, following the 15-year cycle of the topographical service in its aerial photography.

[1412]. 09.4 (71). CANADA. **Estimate of forest production operations in the woods in Canada, 1945.** Dominion Bureau of Statistics, Ottawa. 1947. pp. 14. [E.F.]

[1413]. 09.4 (81). Estatistica florestal. Classificação das madeiras. **[Forest statistics. Classification of timbers.]** Serviço de Informação Agrícola, Ministerio da Agricultura, Rio de Janeiro, Brasil. 1946. pp. 100. [Port.]

[1414]. 09.4 (89) : 98.1 : 09.7. **The forest resources of Paraguay.** Institute of Inter-American Affairs, Food Supply Division, Washington, D.C. 1946. pp. 112.

Report on a survey carried out by members of the staff of STICA (Servicio Tecnico Interamericano de Co-operación Agricola), with the following objects: (1) To determine the extent, location and condition of forest lands, and the species, quantity and quality of timber in them. (2) To ascertain the current and probable future productivity of forest areas. (3) To determine the amount of drain through felling and losses from fire, insects, disease, etc. (4) To ascertain the present and probable future trend in domestic demand for forest products. (5) To formulate management policies on the basis of these findings. The following tables are included: land use by departments, forest and land ownership, forest density and tree volume by forest type and species, estimated volume by departments, total forest area by classes of timber, timber drain and timber production for 1943–44 by departments, duty charged on exports, and forest employment. There are lists of indigenous timbers with scientific and Paraguayan names.

[1415]. 09.4 (97) : 06.2. **Empire forest resources.** *Timber of Canada* 7 (12), 1947 (49–62).

A full summary of the various statements presented by member nations of the British Commonwealth to the British Empire Forestry Conference.

09.7. *Monographs of Individual Forest Regions*

See also *For. Abstr.* 9

(Nos. 1399–1400, 1408–15, 1795).

[1416]. 09.7 (485). LÖWEGREN, G. **The forest and forest industries of Norrland.** [A popular summary.] *Suppl.* to *Svenska Handelsbankens Index* Sept., 1945. pp. 63 + map [E.] P.R.

[1417]. 09.7 (492) : 23.23 : 23.21 : 81 : 92. STEIJN, J. A. VAN. **Forestry in the Netherlands and the State Forest Service.** *Forestry* 21 (1), 1947 (14–29 + plates).

The Director of the Netherlands State Forest Service reviews the forest area, timber position, climate and soil of the Netherlands, gives a short historical survey of Dutch silvicultural practice since the beginning of the 19th century, and the choice of species and mixtures for afforestation [cf. *For. Abstr.* 8 (No. 873)], the work and organization of the forest service, and forest legislation. Notes are added on methods of afforesting peatlands and sand dunes.

[1418]. 09.7 (498). RADULESCU, M. Delta Dunării din punct de vedere silvic. [**The Danube delta from the forestry point of view.**] *Rev. Pădurilor* 54 (11/12), 1947 (450–9). [Rum.f.]

[1419]. 09.7 (571) : 09.4 : 33.32 : 32 : 23.2. KOLOTILOV, I. M. Lesa Yuzhnogo Sakhalina. [**The forests of S. Sakhalin.**] *Bumazh. Prom.* 21 (1/2), 1946 (14–18). [Russ.] L.S.

Southern (formerly Japanese) Sakhalin, with a total area of 36,000 sq. km. has 2,800,000 ha. (77 per cent.) under forest. According to statistics for 1940 there were 235 million cu.m. of standing timber, consisting of 182 million of Spruce and Fir, 15 million of Larch and 38 million cu.m. of hardwoods. The mountain slopes bear mature and overmature forest of Spruce and Fir, with a small admixture of Birch and Aspen, of quality classes 3 and 4 and with a growing stock of 200–250 cu.m./ha. Hardwood forests of various extent are scattered over the lowlands by the sea and in river valleys.

Exploitation began in 1914, since when 750 km. of railway have been built. Nine pulp and paper factories were erected, consuming locally produced coal as well as about 2 million cu.m. of pulpwood and other wood annually. Coalmining, fisheries and sawmilling have also made large demands on the forests. By 1940 the total consumption of wood had risen gradually to 5 million cu.m. (4 million cu.m. in 1944).

Most of the logging was done by the Paper Mills Board (all mills belonged to one combine), which cut only coniferous pulpwood in what were practically clear fellings, commonly of all trees down to 15 cm. d.b.h. Wood down to 8 cm. in top diameter was utilized, practically regardless of defects; no sawtimber or firewood was made and hardwoods were left standing. For every 4·5 million cu.m. of pulpwood obtained, however, it is estimated that a standing volume of 7–8 million cu.m. was actually cut. These fellings were for the most part pure exploitation. One factory built in 1914 had to close down in 1944 owing to its having exhausted the pulpwood supplies within economic range. Five more of the mills have supplies

to last another 4–8 years, and the remaining three enough for 14–20 years.

Fire control has been very strict and fires have been practically confined to felled areas, where, owing to the fact that slash was not cleared, fires and subsequent grass growth have rendered natural regeneration very difficult. The pulp and paper combine established about 100 nurseries and planted 21,000 ha. with Spruce and Fir between 1936 and 1943. Some tens of thousands of hectares (non-regenerated felling areas) were also planted up by the Forest Service. In spite of apparently favourable sites and climate, trials of a Canadian Poplar were for some reason unsuccessful.

Brief sections are devoted to notes on logging and logging tools, floating operations, organizational questions and logging costs.

[1420]. 09.7 (666.8) : 12.26–8. POINSIER, J.-L. Forêt tropicale et sylviculture en Côte d'Ivoire. **[The tropical forests and silviculture of the Ivory Coast.]** *Rev. Bois Appl.* 2 (2), 1947 (23–5). P.R.

Discusses generally the present state of the Ivory Coast forests and the experimental cultivation of *Musanga smithii* and *Ceiba pentandra*. [Cf. *For. Abstr.* 9 (No. 1481).]

[1421]. 09.7 (669). COLLIER, F. S. **Informal notes on forestry in Nigeria.** *Fm. & For.* 7 (2), 1946 (128–33).

[1422]. 09.7 (712). ROBINSON, J. L. **Agriculture and forests of Yukon Territory.** *Canad. geogr. J.* 31 (2), 1945 (54–72). O.G.

South of latitude 65°, in an area of about 110,000 sq. miles, it is estimated that about 15 per cent. of Yukon Territory may be considered as normally growing forest; 35 per cent. is classed as scrub or unproductive forest, and the remaining 50 per cent. as water, tundra or barren. The timber areas are in strips along the rivers and flat bottomlands, and are thus fairly accessible. They could probably sustain an annual cut of 50–100 million bd. ft.; the present annual cut is about 1½ million bd. ft. and 20,000 cords. Fuelwood is very largely used by the large Yukon river steamboats. Further development of a forest industry depends on the development of other natural resources and increase in population.

[1423]. 09.7 (714). BÉDARD, A. **Forestry in Quebec, past, present, future.** *Canad. geogr. J.* 28 (6), 1944 (258–80 + plates). O.G.

[1424]. 09.7 (729.6). RICHARDSON, J. H. **Review of Bahamian economic conditions and post-war problems.** Nassau Guardian, Ltd., Nassau, New Providence, Bahamas. 1944. pp. 150.

The section of the report dealing with forestry (pp. 84–8) stresses the fact that, while large quantities of Pine and smaller quantities of hardwood timber are cut every year and used both locally and for export, little is done in the Colony for forest conservation or for reforestation. It suggests that special measures should be taken for forest fire prevention, and experiments made in raising hardwood seedlings in nurseries and transplanting them to areas reserved for afforestation and protected against fires. Improved methods are necessary for the production of charcoal, which is used widely for domestic purposes. The Department of Agriculture should include a forester on its staff.

[1425]. 09.7 (87) : 12.19.2. WILLIAMS, L. **Forests of the Upper Orinoco.** *Trop. Woods* No. 91, 1947 (17–38 + plates).

A general descriptive account of the forests seen during travels in this part of Venezuela. [Cf. *For. Abstr.* 3 (281).]

[1426]. 09.7 (881). HUGHES, J. H. **Forest resources of British Guiana.** "Daily Chronicle," Ltd., Georgetown, Demerara. 1947. pp. 146. (Section 5 of *Handbook of natural resources of British Guiana.*)

Includes descriptions of the accessible commercial forests, under the heads of climate, soils, topography, forest types, injuries, estimated volume, and possible methods of exploitation and extraction; also brief descriptions of the principal timber species and the forest industries.

[1427]. 09.7 (94). GRENNING, V. **Forest management in Australia.** Govt. Printer, Brisbane. 1947. pp. 8. (Fifth British Empire Forestry Conference, Great Britain, 1947.)

[1428] 09.7 (944) : 94.11. VINCENT, R. S. **The Pilliga National Forest.** Forestry Commission, New South Wales. [1947?] pp. 16 + map.

A popular account of the largest national forest in New South Wales, covering an area of 612,565 acres, with notes on the climate, principal species, and economics of exploitation.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.4. *Soil*

See also *For. Abstr.* 9 (No. 1515).

11.41. Soil Physics

See also *For. Abstr.* 9 (No. 1444, 1485).

[1429]. 11.41.1 : 11.2 : 11.3 : 11.44 : 12.19.2–3 : 13.15. SAKHAROV, M. I. Faktorȳ, reguliruyushchie promerzanie pochv v lesnȳkh fitotsenozakh. [**Factors governing soil freezing in forest coenoses.**] *Pedology* 1945 (8), (381–402). [Russ.e.] [Bryanski Lesokhozyaystvennȳ Institut.] H.S.B.

A review, based on personal investigations and literature, of factors affecting thermal conditions in forest soils, with particular reference to freezing. These are grouped as follows: (1) *Climatic factors*, with special mention of the influence of snow depth and porosity, the chief factors governing the latter being wind, thaws and frequency of snowfalls. (2) *Orographic factors*—Owing to increases in the intensity of light radiation and snow depth with increasing altitude, mountain soils at certain levels may not freeze at all even in cold winters; above these levels, owing to decreasing snow depth, there is progressive cooling of the soil. With pronounced variation in relief there may be inversions of air temperature, a phenomenon especially noticeable in Siberia, e.g. average January temperatures are – 40° C. at Yakutsk (altitude 102 m.) and – 28° at Semenovsk (alt. 1,020 m.). If variation in relief is comparatively small, such effects are cancelled by other factors: on high ground in the Kazan region, soil freezing before the snows was 38 cm. deeper than in adjacent (moist) depressions, and a difference of similar order occurred after snowfalls. Forest cover tends to mask the effects of small variations in relief, largely because there is less blowing of snow from elevations into depressions. (3) *Edaphic factors*—Heat absorption increases and conductivity decreases with increasing humus content. The results of several experiments at Kazan and Bryansk are quoted to show the marked protective effect of litter and similar, though smaller, effects of the moss layer against the freezing of forest soils, e.g. exposure of the mineral soil under a 50-year-old Aspen/Lime stand increased the depth of freezing from 5 cm. (controls) to 35 cm. A high water-table increases the heat absorption and conductivity of the soil, leads to accumulation of a humus layer and, in coniferous woods, gives rise to a deep carpet of litter and mosses. These factors conserve heat in winter and keep the underlying soil cool in summer. (4) *Biotic factors*—(i) *Forest vegetation*, the variations of which in density, age, composition and structure, are accompanied by changes in the heat relations of the soil, e.g. in *Pinetum hylocomiosum* soil freezing was deepest at an age of 20–40 years (greatest closure and thinnest snow cover), and in Aspen/Lime at 15 years of age. Except for Silver Fir, Spruce permits the greatest soil freezing of Russian species, owing to the considerable interception of snow by its long dense crown. (ii) *Fauna* (both below and above ground), *human influences, and fire.*

In conclusion the author suggests the following measures to decrease soil freezing: (*a*) Promotion of good snow and litter cover by regular thinning, creation of mixed coniferous/deciduous stands, broadcasting of slash etc., fire protection, and introduction of underwood along margins. (*b*) Improvement of heat absorption and lowering of conductivity in the upper soil layers through an increase of the humus content etc., by introducing second-storey and underwood species and by controlling grazing.

[1430]. 11.41.5–6 : 22.1 : 11.49.4 : 11.62.1. GULISASHVILI, V. Z. Izmenenie osnovnȳkh elementov fizicheskikh svoystv burȳkh lesnȳkh pochv pri rubkakh lesa. [**Changes in the chief physical properties of brown forest soils after fellings.**] *Pedology* 1946 (9), (539–49). [Russ.] [Sel'skokhozyaystvennȳ Institut im. L.P. Beriya, Tbilisi.] H.S.B.

Investigations were made in Transcaucasian mountain forests (Oak/Hornbeam on the lower slopes and *Picea orientalis*, *Abies nordmanniana* and *Fagus orientalis* above) to discover what grade of selective felling could be applied without detriment to the soil. Soil properties were also studied on clear fellings for comparison.

Results showed that clear fellings decreased the total porosity of the soil, in some cases to a very slight extent only: non-capillary porosity (on which permeability to water directly depends) was in all cases materially reduced.

Selective fellings reducing crown density to 0·5 caused no change of any consequence in either total or non-capillary porosity. With crown density reduced to 0·3, total porosity was reduced, in some instances materially, and there was in all cases a considerable drop in non-capillary porosity. If, therefore, the water-regulating functions of the soil are to be conserved, a crown density of 0·5 is the minimum requirement for the forests in question, and where regeneration fellings have to be made this should not be forgotten. The data are summarized in tables.

11.43. Biology of Soil, including Mycorrhiza

See also *For. Abstr.* 9 (Nos. 1457, 1621).

[1431]. 11.43 : 11.41.8 (576) : 11.44 : 12.14.3. GHILAROV, M. S. **Distribution of humus, root systems and soil invertebrates within the soil of the Walnut forests of the Ferghana mountain range.** *C.R. (Doklady) Acad. Sci. U.R.S.S.* 55 (1), 1947 (49–52). [E.] O.R.S.

[1432]. 11.43.1 : 12.25 (729.88) : 11.47.21. [***Pinus caribaea* in Trinidad.**] *Rep. For. Dep. Trin. Tob. 1946*, 1947 (8).

Previous attempts to grow *Pinus caribaea*, the Slash Pine of the Southern States of the U.S.A., which is also found in British Honduras and the Bahamas, have proved unsuccessful in Trinidad, and it is believed that the failures may have been due to an absence of the mycorrhizae which are normally associated with conifers. Some topsoil was accordingly obtained from a Slash Pine plantation in British Honduras, mixed with the local soil, and then sown with Pine seed. At the end of the year, the resulting seedlings were small but healthy.

[1433]. 11.43.1 : 12.25 : 23.24 : 44.3 : 11.47.21. DOMINIK, T. Znaczenie mikroflory glebowej dla rozwoju sadzonek sosnowych. **[The rôle of the soil microflora in the rate of growth of Scots Pine seedlings.]** *Przegląd leśniczy, Poznań* July, 1946 (7–12). [Pol.] P.R.

Describes an experiment carried out by the author in the forest district of Stary Tomysl (Western Poland) in 1937–38, to determine the effect of forest microflora on the growth of Scots Pine seedlings on old arable soils. Scots Pine plantations on such soils have, as a rule, succumbed to root rot when 20 to 60 years old. The author, presuming this dying-off to have been caused by the absence of a microflora suitable for forest trees, decided to attempt to inoculate arable soils with the microflora of a climax forest association. Three experimental plots (with three replications) were laid out on old arable land, a heavily manured and limed sand on clay, having a pH value from 6·5 to 7·5 and situated 100 m. from healthy, pure Scots Pine about 90 years old, standing on deep, fresh sand of pH 4·3. The plots were planted in the spring of 1937 with 1-year-old Scots Pine seedlings from a forest nursery. Forest soil from the A_1 horizon of the neighbouring Pine stand was dug in and mixed with the original soil in plots I, and put only in the planting holes in plots II; plots III served as controls. Next spring, seedling heights on I were 29–35 cm., on II 23–30 cm., and on III 22–23 cm., and their total length (stem plus root) 78–79, 66–72 and 55–66 cm. respectively. Seedlings simultaneously planted as a routine measure in the same forest that supplied the soil, averaged 33 cm. in height and 74 cm. in total length. The roots of all seedlings had mycorrhiza, which on control seedlings showed greater morphological variety. This, according to the author, may have been due to the activity of some 'undesirable' fungi which might have caused the wholesale mortality of Scots Pine on old arable soils, though this theory could not be tested by isolating species. The author believes that inoculating with forest microflora even if limited to the planting holes (a cheap procedure) is of importance, as it assists the development of mycorrhiza on the seedling roots and also protects the roots from being affected by undesirable fungi found in old arable soils.

[1434]. 11.43.2 : 11.42 : 11.44 : 11.49. FENTON, G. R. **The soil fauna: with special reference to the ecosystem of forest soil.** *J. anim. Ecol.* 16 (1), 1947 (76–93).

The techniques employed in assessing soil populations are described in some detail; also the importance of humus as a reservoir of plant food, its distribution in the soil, and the rôle of the mesofauna in effecting this distribution. It is suggested that one of the primary factors determining the distribution of the mesofauna is the palatability of the leaves, which is closely related to their calcium content. The factors at play in the formation of mull are

described, with particular mention of the work and suggestions of Müller, Bornebusch and Jacot in this field. Podzol formation is similarly treated though here the only experimental work cited is that of Jacot. The part played by animals in the nitrogen cycle and their action in speeding up and possibly determining the course of decay is outlined. The extensive bibliography of 8–9 pages covers a wider field than the text, including literature on agricultural pests and mycorrhiza. *From author's summary.*

11.44. Litter. Surface Humus

See also *For. Abstr.* 9 (No. 1621).

[1435]. 11.44 : 11.42 (712.1). GROSS, R. A. **The composition and classification of forest floors and related soil profiles in Saskatchewan.** *Sci. Agric.* 26 (12), 1946 (603–21).O.R.E.

Investigations concerned with the classification of forest floors in Saskatchewan were carried out and the following observations made:—(1) A lighter leaf fall and thinner organic mat development is observed in Saskatchewan forests than in forests of north-eastern United States. (2) The forest floors of Saskatchewan belong to the mor group. Three mor types were encountered, namely granular, matted and dry mor. The latter occurred under Jack Pine. The name 'dry' mor has been suggested owing to the very thin nature of this forest floor type and the existing classifications do not include a type similar to this.

Chemical analysis revealed that :—(1) The granular and dry mor types are more acid than matted mor. (2) Humus layers of matted and dry mor are higher in mineral content than the corresponding layers in granular mor. (3) Litter under deciduous trees is higher in mineral content than litter under conifers. (4) Humus layers in dry mor are lower in total nitrogen than humus layers in granular or matted mor. (5) Almost all the nitrogen in matted and dry mor was recovered in the resistant lignin fraction, but in granular mor about 25 per cent. of the nitrogen was hydrolysed by dilute acid and boiling water. (6) The C/N ratios for humus layers of granular and dry mor are higher than the C/N ratios for humus layers of matted mor. (7) The factor for calculating the percentage of organic matter from a knowledge of the percentage of organic carbon is highest for dry mor and lowest for granular mor. (8) No consistent differences were noted between different forest floor types as regards amount of ether-, alcohol- and water-soluble materials. The ether-soluble materials decrease fairly rapidly as the leaf litter is decomposed and these materials in granular mor are slightly acid to litmus. (9) For granular mor, hemicelluloses increase with decomposition of the leaf litter, whereas this fraction decreases with decomposition of the litter of other mor types. (10) For all forest types there is a rapid decrease in cellulose content with decomposition of the leaf litter. (11) There is a steady increase in lignin content of the organic matter with decomposition of leaf litter.

Shallow peats are similar to forest floors in chemical composition. Chemical analysis of sphagnum peat shows a very high hemicellulose content. *Author's summary.*

[1436]. 11.44 : 12.11.11 : 12.19.2 : 11.42. DZENS-LITOVSKAYA, N. N. Zol'nyĭ sostav lesnoy rastitel'nosti v Saval'skoy lesostepi. **[The ash composition of forest vegetation in the Saval'skaya forest steppe.]** *Pedology* 1946 (4), (209–26). [Russ.] H.S.B.

A detailed account of ash analyses, made over a period of 2 years, at different seasons, of leaves, branches, stems and roots of the trees and associated shrubs and herbs of 3 vegetation types on 3 different soils: (1) Oak/Lime, with *Euonymus verrucosa, Acer tataricum* and various herbs; (2) Oak/Aspen/Lime with *Pteridium aquilinum*; (3) Aspen/Oak/Lime with *Corylus avellana* and *Carex pilosa.*

Results, which are set out in 15 tables, showed that each species examined, in spite of growing in the same habitat, had its own characteristic composition as regards mineral elements. On different soils the composition of a given species varied, but within comparatively narrow limits. The quantity of mineral oxides in the ash of the Oak/Lime/*Euonymus* type considerably exceeded that for the Oak/Aspen/Lime with bracken; the latter, however, chiefly owing to the high ash content of the Aspen leaves in autumn, returned considerably greater quantities of mineral oxides to the soil. In the Aspen/Oak/Hazel type one-half of the quantity of mineral oxides returned by leaf-fall was supplied by the Aspen leaves. Although

the data are not complete the following summary table gives some indication of the quantities involved (in kg./ha.: (*a*) = quantities in ash of the associations, (*b*) = quantities returned annually to the soil in litter):—

	(1)		(2)		(3)
	(*a*)	(*b*)	(*a*)	(*b*)	(*b*)
SiO_2	1,102	80·52	574	164·37	134·64
Al_2O_3	224	3·10	156	4·67	6·25
Fe_2O_3	185	3·48	121	5·42	5·49
Mn_3O_4	—	3·19	—	3·01	1·55
CaO	4,490	107·62	3,033	172·92	178·27
MgO	506	22·62	431	27·55	38·55
K_2O	812	68·29	1,216	78·81	60·95
Na_2O	299	16·67	250	9·24	15·89
P_2O_5	341	19·75	232	17·24	19·17
SO_3	570	17·37	423	36·06	23·79
Totals	8,512	357·44	6,655	510·16	489·83

[1437]. 11.44 : 12.11.11 : 12.19.2 : 11.42. TATARINOV, S. F. Ob akkumulyatsii zol'nykh elementov v lesnykh podstilkakh. [**The accumulation of ash elements in forest litters.**] *Pedology* 1946 (7), (412–9). [Russ.e.] [Sel'skokhozyaystvennyy Institut, Chkalov.] H.S.B.

Litter, soil, and needle analyses were made in 3 forest stands on strongly podzolized soils in the Kichmen—Goradets district, Vologda, viz. (*a*) Norway Spruce forest (*Piceetum myrtillosum*) on sandy loam, (*b*) the same type of forest on silt loam, (*c*) Scots Pine forest on sand. Results are tabulated in detail.

The relative contents of the various ash constituents, arranged in descending order, were: (1) *Spruce needles*—SiO_2; CaO; MgO; P_2O_5; Al_2O_3; Fe_2O_3. (2) *Pine needles*—CaO; SiO_2; MgO; P_2O_5. Pine needles contained less of each mineral constituent than Spruce. (3) *The soil proper*—Al_2O_3; SiO_2; Fe_2O_3; CaO and MgO; K_2O_5 and P_2O_5. (4) *Litter*—SiO_2 and CaO; MgO and Al_2O_3; P_2O_5, K_2O and Fe_2O_3.

Litter, soil, and needles differed in both the relative proportions and the absolute quantities of their mineral constituents. There were differences between Pine and Spruce litter and between litter of Spruce from the two different soils bearing the same forest type.

Distribution of the constituents by litter horizons also differed with soil type. The mineral constituents (total for all litter horizons) were recalculated for the three stands, in metric tons per ha., as:—

	(*a*)	(*b*)	(*c*)
SiO_2	9·42	10·32	3·12
Al_2O_3	2·65	2·98	1·15
Fe_2O_3	0·58	0·80	0·36
CaO	3·83	3·20	1·89
MgO	1·57	1·42	0·41
K_2O	1·04	1·16	0·51
P_2O_5	0·99	1·15	0·67

Accumulation of ash elements in litter is ascribed chiefly to (i) colloid-chemical reactions occurring in conditions of a high content of negatively charged humus colloids and an acid reaction; (ii) its 'biological absorptiveness'. The factors influencing amounts and distribution in the litter layers are vegetation type, biochemical reactions, soil properties and uptake by plants.

11.47. Maintenance of Favourable Soil Conditions

See also *For. Abstr.* 9 (Nos. 1432–3, 1447, 1537).

[1438]. 11.47 : 11.49.0 : 11.42.1 (437). NĚMEC, A. Vliv hnojení a vytrvalé lupiny na vlastnosti degradovaných lesních půd. Podzol s ortšteinem v polesí Cep u Třeboně. [**The influence of fertilizing and of perennial lupin on the properties of degraded forest soils. Podzol with hardpan in the Trieschel bei Wittingau forest district.**] *Repr.* from *Sborn. české Akad. zeměd.* 18 (2), 1943 (175–87). [Cz.g.]

Cf. *For. Abstr.* 4 (86). The present paper discusses the effects on the soil of combined heather clearing, mechanical cultivation, liming, fertilizing, and growing of perennial lupin. Over a period of 15 years the control plots, which were merely cleared of heather and cultivated, have continued to show stunting of Scots Pine and Norway Spruce, Alder has died out, and the soil profile reveals renewed podzolization and hardpan formation. On plots given the combined treatment, not only have the tree species shown thrifty growth, as previously reported, but the soil profile has developed the morphological features of a good brown forest soil. Marked differences have

been brought about in the chemical properties of the soil, the controls being much the more acid and containing less N and less P_2O_5, CaO, MgO and K_2O in the top 30–40 cm. It is chiefly to the chemical improvements in the soil that the success of the combined treatment must be attributed.

[1439]. 11.47.1. **Miscellaneous methods of fertilizer application.** *Soils & Fertil.* 10 (2), 1947 (117–22).

Various methods of applying fertilizers have recently been developed, and the literature on them is here reviewed. The following methods are described:—Injection into the soil, injection into the plant, application in solution and in irrigation water, briquettes and 'nests', coating seed with fertilizer, and distribution of liquid manure.

11.49. Soil Types

See also *For. Abstr.* 9 (No. 1476).

[1440]. 11.49 (437) : 11.42 : 42.5. PELÍŠEK, J. Charakteristika lesních půd na bítešské rule v podhoří Českomoravské vysočiny. [**The nature of the forest soils on Bitеš gneiss in the foot-hills of the Bohemian-Moravian plateau.**] *Lesn. Práce* 26 (2), 1947 (41–52). [Cz.e.]

Seven main groups of soils are recognized for the region and profiles are briefly described. They include skeletal and podzolized soils, podzols and kaolinitic soils. The last-named have a high content of soluble Al, which is toxic to and causes stunting of the forest growth. All the soils are very acid and tend to accumulate raw humus, and most are deficient in mineral nutrients, especially CaO, MgO, K_2O and P_2O_5. [Cf. *For. Abstr.* 9 (Nos. 1863–6).]

[1441]. 11.49.6 (661:665) : 11.62.1. AUBRÉVILLE, A. Érosion et 'bovalisation' en Afrique noire française. [**Erosion and 'bovalization' in French Guinea and French West Africa.**] *Agron. trop.* 2 (7/8), 1947 (339–57). [F.]

A '*boval*' (plural *bové*) is the native name in French Guinea for a natural opening in the forest, bearing a poor savanna vegetation and a few shrubs, and which may vary in extent from a few metres to several km. long. They occur on fossilized, ferruginous soils somewhat resembling laterite, which form at a considerable depth, on a level with the water table. When such soils are denuded by the disappearance of their upper horizons they harden into a cement-like substance and the result is the formation of a 'boval'. This process of 'bovalization' appears to have taken place largely in the Quaternary era, but is still active to-day as a result of soil erosion due to burning, overgrazing, etc. The author describes the process of formation and the woody vegetation found on the 'boval', including the common phenomenon of nanism. If fire were excluded, it is probable that the reconstitution of forest soils would gradually take place, starting with the effects of the very wide-spread species of Cyperaceae, *Eriospora pilosa*.

11.6. *Hydrographical Conditions. Water and Soil Conservation*

See also *For. Abstr.* 9
(Nos. 1430, 1557, 1560, 1562–4, 1876).

[1442]. 11.6 (71). HOPKINS, E. S. **A soil conservation program for Canada.** *Agric. Inst. Rev.* 2 (5), 1947 (335–43).

The author suggests a soil-conservation programme for Canada as a whole with the following among its general objectives: Soil conservation methods should conform to the requirements of the widely differing soil and climatic conditions prevailing in the various parts of the country: in Eastern Canada, for example, the problems are, in order of importance, low soil fertility, poor drainage, soil erosion, improper land use, and flood control, while in the Prairie Provinces soil erosion is the outstanding problem. The soil survey should be followed by an agronomic survey for the purpose of ascertaining the soil fertility requirements and crop adaptation of the various soil types. Meteorological stations should be established throughout Canada, particularly for precipitation and temperature records. A plan should be developed for the utilization of submarginal land, land suitable for arable farming being reforested or used for grazing. Technical information and equipment should be made available to the farmer, and other inducements offered for the promotion of soil conservation practices.

[1443]. 11.62 : 11.14.4 : 12.25. WILM, H. G. **The effect of timber cutting in a**

Lodgepole-Pine forest on the storage and melting of snow. *Trans. Amer. geophys. Union* Pt. I, 1944 (153–5). [Rocky Mountain Forest & Range Experiment Station.] L.S.

Report on a detailed experiment in Fraser Experimental Forest, Colorado. [Cf. *For. Abstr.* 4 (215); 5 (32); 6 (7); 9 (No. 80).]

For mature Pine forest the results showed that initial snow storage and duration of melting increased with the average distance of any sampling point from the surrounding crowns; the smallest quantities of snow were stored within dense clumps of trees, and the largest amounts in the largest available openings, about 60 ft. in diameter. After the treatments were applied, timber cutting exerted a strong influence on the amounts of water stored in snow before melting began in the spring and on the amount of precipitation added to the snow and soil between the first snow survey and 30 June. Snow on the cut-over areas melted more rapidly than on the uncut plots, but this was compensated by the excess snow stored initially so that at the end of each season all 20 plots became bare at practically the same time.

[1444]. 11.62 : 11.41.3 : 11.14.3 : 12.25. WILM, H. G. **Soil moisture under a coniferous forest.** *Trans. Amer. geophys. Union* Pt. III, 1943 (11–13). [Rocky Mountain Forest and Range Experiment Station.] L.S.

Report on a detailed experiment on the Fraser Experimental Forest, Colorado [cf. *For. Abstr.* 5 (32); 6 (7); 9 (No. 80)]. Soil-moisture deficiencies in the season of 1941 were strongly affected by the cutting treatments, with the greatest deficiencies on the uncut plots and the smallest on the clear-cut areas. It is suggested that these results are due to rainfall interception rather than variations in the sum of transpiration and evaporation; high transpiration on uncut plots may be compensated by high evaporation on the cut-over areas.

[1445]. 11.62.31 (73). PHILLIPS, G. R. **The flood control programme of the U.S. Department of Agriculture.** *J. For.* 45 (10), 1947 (705–11).

Deals in broad outline with the organization set up by the Department of Agriculture to carry on catchment improvement work in the interests of flood control and the methods being employed to that end.

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11.1. *Metabolism. Plant Constituents. Growth Substances*

See also *For. Abstr.* 9 (Nos. 1436–7, 1514–5, 1804–10, 1812, 1814–22, 1824–5, 1863–7).

[1446]. 12.11.11 : 12.11.12 : 21.3 : 42.5. GOODALL, D. W., and GREGORY, F. G. **Chemical composition of plants as an index of their nutritional status.** *Tech. Commun. Bur. Hort. Plantat. Crops, E. Malling* No. 17, 1947. pp. 167. Price 9*s*.

A comprehensive survey of the present state of knowledge of the use of the plant-analysis method to determine the nutritional needs of plants, including trees. The communication deals with (1) theoretical aspects, (2) selection of a technique, method of expression and interpretation of results and (3) the place of plant analysis among methods of nutritional diagnosis. There is a full subject index, an author index to facilitate reference to the numerous authorities quoted, and a bibliography of over 900 items.

[1447]. 12.11.11 : 11.42.2 : 11.47. AUDUS, L. J., and QUASTEL, J. H. **Toxic effects of amino-acids and amines on seedling growth.** *Nature, Lond.* 160 (4059), 1947 (222–3). [University College, Cardiff.]

In the course of experiments on the effect of small concentrations of certain normal metabolites on seedling growth in sterile culture solutions, it has become apparent that a large number of amino-acids and amines have a distinct, and in some cases considerable, toxic action on the growth of cress roots. A table shows, for 18 compounds tried, the concentration at which inhibition is detectible, and per cent. of inhibition of root growth at a concentration of 1,000 p.p.m. These results are discussed in some detail. Many of the inhibiting compounds are normal plant metabolites. How far these phenomena will enter into questions of organic manuring and the specific effects on plants of organic nitrogen molecules in the soil, is a subject for future research.

[1448]. 12.11.11 : 12.26–8. DUNSTAN, W. J., HUGHES, G. K., and SMITHSON, N. L. **A new source of taraxerol.** *Nature, Lond.* 160 (4069), 1947 (577). [Dept. of Chemistry, Univ. of Sydney.]

The triterpene, taraxerol, isolated from the roots of *Taraxacum officinale*, has been obtained from the bark of *Litsea dealbata*. The yield is good and purification simple, and there being, apparently, no other triterpenes present, it is intended to investigate some aspects of the chemistry of this substance.

[1449]. 12.11.11 : 12.26–8. MOOKERJEE, A., and BOSE, P. K. **On the constitution of the alkaloid isolated from the bark of *Chloroxylon swietenia*, D.C.** *J. Indian chem. Soc.* 23 (1), 1946 (1–5). L.S.

The alkaloid isolated from the bark of *Chloroxylon swietenia* proved to be identical with skimmianine, previously isolated from 6 Rutaceous species.

[1450]. 12.11.15. TINCKER, M. A. H. **Chemical regulators of plant growth.** *Research, Lond.* 1 (1), 1947 (11–18).

A review of progress to date, citing some 40 references.

12.11.2. *Reproduction. Propagation. Growth. Development*

See also *For. Abstr.* 9 (Nos. 1455–6, 1458, 1463–4, 1467, 1514, 1525, 1530).

[1451]. 12.11.21 : 12.26–8 : 13.15 : 13.2. STÄGER, R. Die Edelkastanie (*Castanea sativa* Mill.) in botanischer und entomologischer Hinsicht. [**Sweet Chestnut (*Castanea sativa* Mill.) from the botanical and entomological point of view.**] Hans Lüthy, Bern. [1946?] pp. 36 + 1 plate. [G.] L.S.

Some observations made by the author on the fertilization of *Castanea sativa* and on a considerable number of insects visiting and inhabiting the trees, with a particular note on ants and aphids.

[1452]. 12.11.21 : 12.26–8 : 12.11.3. PYATNITSKI, S. S. Ob opylenii u dubov i prorastanii pyltsy na ryl'tsakh. [**On pollination in Oaks and the germination of pollen on the stigmas.**] *Dokl. Akad. Nauk S.S.S.R.* 56 (5), 1947 (545–7). [Russ.] [Ukrainski Nauchno-issledovatel'ski Institut Agrolesomelioratsii i Lesnogo Khozyaystva, Kharkov.] D.S.I.R.

In view of the great difficulty of judging by external appearance whether stigmas of *Quercus* spp. are receptive or not, female flowers of *Q. robur*, *Q. macrocarpa* and *Q. borealis* var. *maxima* were isolated and pollinated on different days, beginning about 20 April and ending 10–14 days later, with pollen of the same species. Twenty-four hours after each pollination, germination of the pollen was examined and compared with that of a parallel sample *in vitro*. The results showed that stigmas were in some measure receptive throughout the period, but maximum receptiveness occurred 4–6 days after the start of the experiments. Physiologically at least, the species examined are neither protandrous nor protogynous. Since, however, pollen from another tree was shown to germinate on stigmas better than that from the same tree, cross-pollination is favoured to some extent over self-pollination.

[1453]. 12.11.22 : 12.25–8 (489) : 12.11.15 : 11. LARSEN, C. M. **Experiments with softwood [non-lignified] cuttings of forest trees.** *Forstl. Forsøgsv. Danm.* 17 (2), 1946 (289–443). [E.dan.] Also as *Repr.* (*Medd. Nr. 18 fra Skovtræforædlingen, Arboretet, Hørsholm*).

Summarizes the author's experiments (1940–44) on the rooting of non-lignified cuttings, in chapters dealing with the methods used, influence of external factors on rooting, influence of nature of cuttings, use of growth substances. A final chapter contains notes, arranged by genera, which include references to previous literature and to tables and discussions of the author's own results. The chief genera studied were *Abies*, *Alnus*, *Betula*, *Fagus*, *Fraxinus*, *Larix*, *Picea*, *Pinus*, *Platanus*, *Populus*, *Quercus*, *Thuja*, *Tilia* and *Ulmus*. Rooting was obtained in all of these genera, and all species on which more than one experiment was made—even those regarded as the most difficult—were induced to root at some stage of development. Wherever possible, the material employed was genetically homogeneous. The following are some of the main conclusions from the work:—

(1) *External factors* during the rooting period are of the greatest importance. Increased temperature, secured by propagating in the greenhouse or in hotbeds (which were essential

for the rooting of certain species), gave earlier and better rooting, and a rise of only a few degrees could effect great improvement. High air and soil moisture were necessary to avoid excessive transpiration and wilting before the cuttings struck root. As even small changes in microclimate could be disadvantageous, experimental or practical propagation should be done under conditions as uniform as possible. If manure is used for heating, care must be taken to provide a sufficiently thick layer of the rooting medium to prevent infection by rot fungi, and the medium should not be one that encourages the latter. Ordinary gravel proved excellent for this purpose. The pH of the medium seldom had any significant effect, though there was some indication that a neutral medium might be the most favourable. The mineral status, however, was very important in promoting early rooting, e.g. Norway Spruce began to root 1–2 months sooner in a medium watered with a nutrient solution.

(2) *Nature of cutting*, even in a good rooting environment, was of primary importance. (i) Cuttings from the basal part of shoots generally rooted best, though in the case of long shoots of *Populus vernirubens* pieces from the middle gave the highest percentage of rooting. In some species, full-length cuttings (i.e. with the shoot apex intact) of short shoots rooted quicker than corresponding shoots with the apex trimmed off; in others the shoot apices were too tender, and wilting delayed root formation. Oak cuttings taken without a heel gave better rooting than those with a heel of wood. (ii) Time of year was also very important: the optimum time varied with species, and lateral and terminal shoots could react differently though taken at the same time. (iii) In most cases, cuttings from young parents rooted best. (iv) A new method of propagation was developed for Aspen and other species which sucker, consisting in taking greenwood cuttings directly from root suckers or from sprouts on cut pieces of root. [Cf. *For. Abstr.* 7 (No. 1600).] (v) In *Populus vernirubens* different types of shoot, showing unequal capacities for rooting, differ in anatomy. There was an apparent agreement in Norway Spruce between rate of rooting in cuttings of different provenances and the dry-matter content of needles of 1-year-old seedlings of the same provenances. (vi) For hardwoods, given an equivalent stage of development, strong shoots were usually the best material for cuttings. (vii) Accumulation of assimilation products, e.g. in layers, earthed-up plants and grafts, was shown to give much increased rooting in certain instances.

(3) *Growth substances.* Treatment with 3-indole-acetic acid at optimum rates (the concentrations used were mostly 50 or 100 p.p.m.) increased the number of roots per cutting and the percentage of cuttings rooted, but where external factors prevented rapid rooting the growth substance had no positive and in some cases possibly a negative, effect.

Attention is drawn to the need for making the difficult distinction, possible only in individual cases, between the effects on rooting capacity of individual variation in the parent trees and variation in stage of development. In conclusion, it is mentioned that practical application of the results gained is already being made with *Populus vernirubens*, *P. tremula*, and *Alnus* spp., and experiments with *Picea abies* have been extremely promising.

[1454]. 12.11.22 : 12.26–8 : 24.51 : 21.0. El cultivo del álamo 'A.M.' en Argentina. **[The cultivation of *Populus* 'A.M.' in Argentina.]** *Montes, Madrid* 3 (13), 1947 (77–8). [Span.]

An account of the cultivation of *Populus* 'A.M.' in Argentina with further notes on propagation by cuttings. [See *For. Abstr.* 7 (No. 609).]

12.11.3. *Heredity. Breeding. Hybridization. Races and Questions of provenance. Cytology*

See also *For. Abstr.* 9 (Nos. 1452, 1541, 1820, 1905).

[1455]. 12.11.3 (485) : 05.3. SYLVÉN, N. Årsberättelse över Föreningens för växtförädling av skogsträd verksamhet under år 1946. **[Annual report on the work of the Swedish Forest Tree Breeding Association, 1946.]** *Medd. Fören. Växtförädl. Skogsträd* No. 44, 1947. pp. 38. [Sw.]

Detailed reports are made on work in progress at the main Ekebo station and the various branch stations. The following notes refer only to points of special interest: (1) *Picea abies*: Partial or complete colchicine-induced tetraploids continue to show great inferiority in

growth compared with normal diploids, but no judgment of the value of the treatment is yet possible and work continues. At the Dalfors station a trial has shown that results from planting in an inverted turf in the planting pit are considerably better—especially where heavy grass growth or local waterlogging occurs—than those from planting in an inverted turf at the side of the pit or directly in the pit without a turf. (2) *Pinus sylvestris*: Practically all grafts made between 1941 and 1945 have flowered every year or every second year, abundant flowering occurring on grafts only one year old. Few cones have set so far, but there has been a plentiful supply of male flowers for artificial pollinations. Two-year-old presumed tetraploids are not nearly so retarded in growth, compared with normal diploids, as are tetraploids in Norway Spruce. Special propagating frames at the Sundmo branch have been used for two batches of grafts in one year: after about 3 weeks in the special frames the scions have formed shoots, and can then be shifted to ordinary greenhouse benches to make way for a fresh batch of grafts made with scions kept in cold storage. Established grafts can be put out into open beds for the winter. Studies are in progress at this branch on the influence of seed size and weight on plant size, sowing methods (with special attention to seed coverings), effect of shading on reproductive age, treatment of seed orchards for maximum seed production, susceptibility of Pine seedlings to *Phacidium infestans*, optimum seed-extraction conditions, etc. Transplanting of young Pines 2·5–3 m. tall was followed by precocious production of female cones only. At Dalfors a strangulation experiment on Scots Pine and Norway Spruce has shown that this method especially stimulates the production of male cones. Low availability of soil moisture also stimulates flowering. In the Dalfors trials of Scots Pine considerable difference has been noted between progenies of different mother trees in cold resistance. (3) *Larix*: Grafts have been made of various species of Larch on stocks of *L. decidua*, *L. leptolepis* and *L. sibirica*, in order to study effects of the stocks on the flowering period of the scions. Nursery stock of the 1944 sowings was severely attacked in 1945 and 1946 by *Meria laricis*: in 1945 both numbers of *L. leptolepis* in the trial were completely resistant and reached normal size for their age. In 1946 further completely resistant individuals were found in varying numbers among certain provenances of European Larch; almost all of them showed considerable vigour and proved on examination to be spontaneous hybrids between *L. decidua* and *L. leptolepis*. Artificial hybridization of these two species is being done on a rather large scale. (4) *Other conifers*: *Picea sitchensis* × *glauca*, produced in 1942, is proving a very fast grower at Ekebo. At Dalfors *Pinus banksiana* and *P. contorta*, planted in 1942, are doing considerably better than the Swedish *P. sylvestris* used as controls and show no frost damage; *P. resinosa* and *P. strobus* appear to have been failures. Measurements in a plantation of *P. contorta* var. *latifolia* at Grensholm are so promising that this species may have a permanent place in Swedish forestry. Among the other conifers being tried, *Pseudotsuga taxifolia* f. *caesia* is showing vigorous growth. (5) *Populus*: Research has begun at the Ekebo station on the resistance of various Aspen crosses to *Fomes igniarius*. At Sundmo, grafting has proved a good method of inducing flower production in Aspen when catkins are not produced in the natural stands from which it is desired to propagate. At Dalfors *P. tremuloides* × *tremula* is showing the best height growth among the Aspens, and some individuals of this crossing appear to be immune to fungus attack; a certain amount of frost damage, however, suggests that Dalfors is a little too far N. for this hybrid. (6) *Betula*: The first trial plantations of 1942 and 1943 are growing well and differences between the various progenies are beginning to emerge more clearly. The oldest trials of curly Birch (planted 1943) show increasing evidence of the formation of figured wood in the young stems, but differences of stem form and wood structure are occurring between individuals with the same mother tree as well as between different 'families' of individuals. A very imposing tree of *Betula verrucosa*, found at Medle, Västerbotten, is possibly a triploid. All the best 'Grey Birches' so far reconnoitred by the Sundmo branch have proved to belong to *B. verrucosa*. (7) *Alnus*: Two triploid forms have been found in the progeny of *A. glutinosa* and *A. incana* crossed with exotic species. The triploids differ markedly in growth, one being a slow- and the other a fast-growing type.

[1456]. 12.11.3 (485) : 06.1. ARNBORG, T. Sällskapets för praktisk skogsförädling

verksamhet under åren 1941–45. **[The work of the Society for Practical Forest Tree Breeding, 1941–1945.]** *Norrlands SkogsvFörb. Tidskr.* 1946 (2), (220–68). [Sw.]

An illustrated, semipopular account of the history and activities of this Society, which has been working on the lines discussed in a recent book [see *For. Abstr.* 8 (pp. 467–71)] by its former leader, Dr. Bertil Lindquist. The present article contains brief general notes on the selection and registration of élite material, classification of stands for seed collection, establishment of nurseries, progeny trials and grading of planting stock, special trials in progress with Norway Spruce of Central European provenance, grafting and other work towards the establishment of seed orchards, timber studies, studies on forest types and regeneration, collaboration with other persons or bodies interested in tree breeding, and a final section on the forests of the individual members. The present members are 12 forest industrial companies and the Gävleborg County Forestry Board.

[1457]. 12.11.3 : 11.43.1 : 12.26–8. WILSON, J. K. **Variation in seed as shown by symbiosis.** *Mem. Cornell agric. Exp. Sta.* No. 272, 1946. pp. 21.

A study was made of the variation in seed from individual plants of four species, red clover (*Trifolium pratense*), alsike clover (*T. hybridum*), *Sesbania exaltata*, and Black Locust (*Robinia pseudoacacia*). The comparative variation in each collection was ascertained by exposing plantlets to certain isolates of the legume bacteria. The criterion was the nodulated condition of the 30-day-old seedlings. The results indicated that plantlets grown from seed of an individual plant of those species employed may symbiose with a certain isolate, whereas plantlets grown from seed of another plant of the same species may bear no nodules after exposure to the same isolate. This may be taken as evidence that seeds from cross-pollinating individual plants possess unlike generic characters as related to nodulation. Such variations are not embraced in the Linnaean concept of a species, for the Linnaean species is too coarse a unit to separate the variations between individual plants. The data indicate also that the isolates representing several of the proposed cross-inoculation groups are not specific for those groups, for they effected nodules on plantlets of certain species that have been assigned to other cross-inoculation groups. *From author's summary.*

[1458]. 12.11.3 : 12.25 (794). DUFFIELD J. W. **Dates and places of pollen collection by the Institute of Forest Genetics.** *For. Res. Notes Calif. For. Range Exp. Sta.* No. 54, 1947. pp. 5.

Includes a table compiled in order to furnish Pine breeders with the dates and places of pollen collection of various species of Pine, by the Institute of Forest Genetics, Placerville, together with a note on the techniques of pollen collection used at the Institute.

[1459]. 12.11.3 : 12.25 (44) : 52 : 56 : 21. FRANÇOIS, L. Le pin sylvestre de race noble de Saint-Dié des Vosges. **[The superior race of Scots Pine of St. Dié in the Vosges.]** *Rev. Eaux For.* 85 (5–9), 1947 (265–80; 354–73; 414–40; 465–77). [F.]

The author deals in detail with many aspects of the superior race of *Pinus sylvestris* which occurs on siliceous gravels in the neighbourhood of St. Dié, dividing it into three varieties, distinguished by different types of bark. The monograph comprises:—(1) Introduction (general considerations, history of the St. Dié stands, origin of the race, distribution). (2) Morphology and anatomy (height, diameter and volume increment; stem form, form factor, volume tables; bark; branches; ecological factors affecting form; formation of heartwood); yield; comparison with other races of Pine. (3) Management and silviculture.

[1460]. 12.11.3 : 12.26–8 (81). BALDWIN, J. T., JUN. ***Hevea rigidifolia.*** *Amer. J. Bot.* 34 (5), 1947 (261–6). O.B.D.

Hevea rigidifolia was re-collected by the author from a small population in the Rio Uaupès area in Amazonas, Brazil. The species is endemic in that area, which is the centre of variability for *Hevea* and some of its near relations. The characteristics of the species are discussed and the author suggests that *H. rigidifolia* may have originated from intergeneric hybridization of *Hevea* and *Cunuria.* The plants seemed free from South American leaf blight and although of little latex value in themselves may be useful in experimental work.

[1461]. 12.11.3 : 12.26–8 ; 44.3. GRAVES, A. H. **The Brooklyn Botanic Garden**

Chestnut breeding project. *Contr. Brooklyn bot. Gdn.* No. 102, 1945. pp. 10. *Repr.* from *35th Ann. Rep. Nth. Nut Growers' Ass. 1944*, 1945 (22–31).

The object of this project, initiated in 1930, is to develop a timber type of Chestnut which shall be blight-resistant. First crosses were made in 1930, using as the female parents blight-resistant Japanese trees (*Castanea crenata*), and pollen from an American Chestnut (*C. dentata*). The first-generation hybrids showed unmistakable dominance by the American parent and were susceptible to blight (*Endothia parasitica*), though less so than the American parent. Many of them displayed heterosis. It was clear that breeding must be continued further for segregation and recombination of the desired characteristics. The difficulty of doing this with diseased and dying trees was overcome by inarching the tips of shoots from the trunk below the lesion, or from the root collar, and grafting them into the trunk above the lesion. This method of prolonging the life of the hybrids has been eminently successful and flowers are borne each year, which makes further breeding possible. The inarching method restores the bark communication between leaves and roots. The most promising cross so far is a *mollissima* × (*crenata* × *dentata*) with *dentata* incompletely dominant.

[1462]. 12.11.3 : 12.26–8. PANTULU, J. V. **Chromosome number of *Cassia fistula*.** *Curr. Sci.* 15 (9), 1946 (255). [Botany Department, Andhra Christian College, Guntur.] L.S.

The chromosome number $n = 12$ recorded for *Cassia fistula* by Tischler (1921–22) is at variance with that reported by the author, which is $n = 14$. The latter number conforms with the previously reported chromosome numbers for species of *Cassia* not belonging to the subsection *Chamaecristae verae*.

[1463]. 12.11.3 : 12.26–8 : 34.27. CHASE, S. B. **Propagation of thornless Honeylocust.** *J. For.* 45 (10), 1947 (715–22).

Thornless strains of Honeylocust [*Gleditsia triacanthos*] bearing crops of large pods, overcome the objections to the common thorny Honeylocust as a pasture tree. Two of the best clones for this purpose found by TVA are described. Thorny Honeylocust was found to develop thornless shoot growth in the upper and outer region of the tree. Investigations were initiated to determine whether scion wood from this thornless region of trees would produce thornless grafted trees. Studies in 1939 and 1940 showed that thornless scion wood from branches which had definitely ceased thorn production would produce thornless trees. Thornless scion wood from branches which had ceased thorn production only recently or were still producing an occasional thorny shoot, would produce both thorny and thornless trees. Thorny scion wood invariably produced thorny trees; scion wood from thornless trees produced only thornless trees. The permanency of thornless growth produced by thornless scion wood from thorny trees was also studied. Such trees grafted in 1940 did not produce thorns and were still thornless in 1946, and it is believed that they will remain so, since trees normally tend to cease thorn production as they get older.

[1464]. 12.11.3 : 12.26–8 : 12.11.22. BOGDANOV, P. L. **Vegetative hybrids of Poplars.** *C.R. (Doklady) Acad. Sci. U.R.S.S.* 54 (4), 1946 (357–9). [E.] [Central Institute for Silviculture, Leningrad.] O.R.S.

For the production of vegetative hybrids, grafts are made in spring, before the buds break, on rooted cuttings. In the succeeding spring any well grown plants are lifted, cut at the point of union between scion and stock, the stumps replanted in boxes (preferably in the greenhouse) and covered with glass jars to induce callus formation. On the abundant callus produced, up to 50 adventitious buds per stump may be formed, but only 2–3 shoots per stump will survive. Adventitious buds formed at the actual boundary between callus tissues of stock and scion are comparatively rare, but from them vegetative hybrids have been obtained which are intermediate morphologically and anatomically between the stock and scion parents.

Between 1933 and 1937, 330 grafts were made of scions of *Populus nigra*, *P.* '*canadensis*', *P. regenerata*, *P. balsamifera*, and *P. simonii*, all on stocks of *P. suaveolens*. Seventy-seven graft hybrids were obtained, of which some died off at an early stage, some remained alive but developed poorly, and four have made trees of normal appearance, from which cuttings have been taken and have maintained their intermediate characters. Of these four trees two represent *P. suaveolens* + *P. nigra*, one

P. suaveolens + *P.* '*canadensis*' and one *P. suaveolens* + *P. regenerata*. Characters of the two *P. nigra* hybrids are compared with those of the parents.

Vegetative segregation has occurred in rare cases only.

[1465]. 12.11.3 : 12.26–8. BØRSET, O. Vekstforedling av osp. **[Selective breeding of Aspens.]** *Tidsskr. Skogbr.* 52 (5/6), 1944 (81–97). [Nor.]

Suggested methods for and a brief review of past developments in the selective breeding of Aspens. [Cf. *For. Abstr.* 9 (No. 1503).]

12.14. Organography. Morphology. Anatomy. Histology.

[1466]. 12.14.3 : 12.11.23 : 11.41.3. LOBANOV, N. V. **A method for investigating the growth of roots in woody plants under various conditions of soil moisture.** *C.R. (Doklady) Acad. Sci. U.R.S.S.* 55 (6), 1947 (547–50). [E.] [Bryansk Forestry Institute.] O.R.S.

Stoppered lamp glasses containing soil of various moisture contents were dug into the soil near 4-year-old trees of *Fraxinus excelsior* and 3-year-old trees of *Larix decidua, Caragana arborescens, Picea abies* and *Pinus sylvestris*. Rootlets of the trees were introduced through an aperture in the stopper and left for 55–65 days, after which they were dug up and compared with other rootlets of the same tree and with each other. With favourable moisture contents all roots had made good growth, but with soils of low moisture content growth varied according to species. *F. excelsior* and *L. decidua* showed no growth in soils with a moisture content less than 6·11 per cent. by weight of dry soil, and *C. arborescens* no growth with moisture contents less than 5·11 per cent. *P. abies* and *P. sylvestris* showed appreciable growth in soils of 2·07 per cent. moisture content.

[1467]. 12.14.5 : 12.26–8 (54) : 12.11.23 : 21.8. GRIFFITH, A. L. **The stomates and early growth of some timber trees of the Malabar Coast.** *Indian For. Rec.* (*n.s.*) *Silviculture* 6 (2), 1946 (62–92).

Describes a series of investigations on the leaves and their stomates and the early growth of some of the principal timber trees of the Malabar coast of India. The species observed were *Tectona grandis, Dalbergia latifolia, Swietenia macrophylla, Terminalia tomentosa, T. paniculata, Xylia xylocarpa, Anacardium occidentale, Strychnos nux-vomica, Pterocarpus marsupium*, and *Hopea parviflora*. Detailed descriptions are given of the climates of the localities of experiment. Some of the main conclusions drawn are:—(1) The total leaf surface per plant exposed by plants of about 1½ years old and 3 ft. high varies from 3,000 to 16,000 sq. cm. (2) The stomates are generally confined to the lower leaf surface and are only rarely found on the upper surfaces on tender stems in some species. (3) The stomates are roughly of the same size as those of temperate plants. (4) The percentage of leaf surface occupied by the stomates in the lower leaf surface varies roughly from 2 to 4 per cent. (5) The stomates are spaced about 5 diameters apart and this appears to be roughly as near together as they can be without one stomate interfering with the efficiency of its neighbours. (6) These tropical plants appear to have roughly 4 times as many stomates per unit area as are commonly found in temperate plants. (7) The number of stomates per leaf varied from roughly half a million to 34 millions per leaf with an average of nearly 7 millions. (8) The number of stomates per plant (about 1½ years old and 3 ft. high) varied from 72 millions to 539 millions with an average of nearly 250 millions. (9) In the porometer experiments the rate of air flow through the leaf was found to be proportional to the 1·45th power of the mean diameter of the stomate. The correlation was statistically significant. (10) In the porometer experiments the flow was that of stream-line flow and the critical velocity at which steady eddy motion would start was not even approached. (11) Observations on rate of height growth showed in general 4 periods of active growth in the year. The relative intensities of growth during these periods varied greatly with the different species. (12) The rate of height growth in the October/November growth period in the case of species characterized by a strong leading shoot showed a close correlation with the total leaf efficiency of the plant as measured in the experiments. *Author's summary.*

[1468]. 12.14.8 : 12.26–8. LINDQUIST, B. Studien über die Stammrindentypen der Gattung *Betula* L. **[Studies on the types of**

stem bark in the genus *Betula*.] *Repr.* from *Acta Hort. berg.* 14 (4), 1946 (91–132). [G.]

An illustrated account of morphological and anatomical studies, undertaken as preliminary work towards a monograph of the Scandinavian Birches, of the types of bark and lenticels occurring in native and cultivated species of Birch in Sweden. Variation in bark characters (especially colour, shine, occurrence of smooth or rough bark in their various forms) was found to be extremely wide in many of the species examined. In a few, e.g. *Betula maximowicziana*, the bark is sufficiently characteristic for recognition of the species by this feature alone: in others, e.g. *B. verrucosa*, the bark varies from smooth and shining to the most pronounced forms of rough fissuring. Though the bark types overlap the botanical species, certain types may be the most frequent ones in a given species or race, e.g. the forms of *B. verrucosa* found in the interior of Norrland always appear to be essentially smooth-barked, even as old trees, whereas in S. Sweden the forms of this species usually develop rough fissured bark, sometimes extending for 10–15 m. up the stems. About 30 species are discussed.

12.19. Geographical Distribution. Plant Geography and Sociology

[1469]. 12.19 : 12.25 (44). CARLES, J. L'étage du pin sylvestre. [**The Scots Pine belt.**] *Rev. sci., Paris* No. 3625, 1947 (73–81). D.S.I.R.

Describes the occurrence of Scots Pine in the mountain regions of east and south-east France.

12.19.1. *Regional Floras, including Check Lists*

See also *For. Abstr.* 9 (Nos. 1490–1).

[1470]. 12.19.1 (757). HUNT, K. W. **The Charleston woody flora.** *Amer. Midl. Nat.* 37 (3), 1947 (670–756).

[1471]. 12.19.1 (759). BUSWELL, W. M. **Native trees and palms of South Florida.** *Bull. Univ. Miami* 19 (6), 1945. pp. 54.

12.19.2-3. *Vegetation Types*

See also *For. Abstr.* 9 (No. 1952).

[1472]. 12.19.2–3 : 01.3. KÜCHLER, A. W. **A geographic system of vegetation.** *Geogr. Rev.* 37 (2), 1947 (233–40). O.G.

The author, who is working at the construction of a vegetation map of the world, discusses the various systems of nomenclature for vegetation types which have been used by botanists and geographers, finds them all unsatisfactory for use on maps, and proposes a new system in which a few basic groups (mostly broad forest types) are designated by capital letters, and a larger number of qualifications designated by small letters. Grasses and herbaceous plants are all combined under the one letter *G*. Woody plants are in 4 main groups *B*, broadleaf evergreen; *D*, broadleaf deciduous; *E*, needle-leaf evergreen; and *N* needle - leaf deciduous. (Under the term 'needle-leaf' the author comprehends scale-like leaves such as those of some Cypresses.) To these are added the capitals *M* for mixed growth of *D* and *E*, and *S* for semi-deciduous vegetation composed of *B* and *D*. The capitals stand for trees unless qualified by *s* (shrubs) or *z* (dwarf shrubs). The other qualifying letters are *l*, low; *m*, medium; *t*, tall; *h*, herbaceous plants other than grasses; *a*, arid; *b*, barren; *c*, continuous, dense growth; *d*, dominant; *g*, galeria forms and vegetation limited to the neighbourhood of water, e.g. Mangroves; *i*, interrupted; *p*, growth singly or in groves or discontinuous patches; *r*, rare; *e*, epiphytes occur in abundance; *l*, lianas are conspicuous; *k*, succulents are conspicuous; *w*, aquatic vegetation.

[1473]. 12.19.2–3 : 34.3 : 91.1 (747). BARICK, F. B. **Environmental analysis of forest edges in relation to wildlife.** *Trans. N. Amer. Wildlife Conf.* No. 10, 1945 (126–36). [New York State College of Forestry.] B.A.P.

A study was made of the forest-edge vegetation in the Huntingdon Forest at Newcomb, N.Y. This report is confined to a study of the vegetation. Data were gathered from a series of transects, using plots instead of a continuous strip, with a different size of plot for tree canopy, underbrush and herbs respectively. Data were transcribed from field sheets to graphical analysis forms and later set out on a statistical basis. The methods and the application of the results to game management problems are illustrated and discussed.

[1474]. 12.19:2–3 (667) : 13.15. CANSDALE, G. S. **Vegetation and fauna in the Gold Coast.** *J. Soc. Pres. Fauna Emp.* No. 55, 1947 (37–9). B.A.P.

A broad correlation exists between the fauna and the major vegetation types in the Gold Coast, but there are several apparent anomalies. The south-west corner of the colony is floristically quite distinct, with several large species of trees forming an appreciable part of the forest crop although they are unknown or uncommon elsewhere; the storeyed structure of the forest is peculiar and the area enjoys the heaviest rainfall in the country; yet no mammals are endemic to that area. A narrow coastal strip is covered with a type of thicket/scrub vegetation, which is in most cases so constantly interfered with by man that the climax form is never allowed to develop. This has often been considered to be a high forest degraded through long-continued burning and farming, but careful study has shown it to have a distinct flora and structure, and it is undoubtedly a quite separate floral type; but its mammalian fauna appears to be largely that of the closed forest contiguous to it on the north, and not that of the savanna forests of the south-east. The presence or absence of a ground layer of grasses would seem to be a very important factor in determining the fauna of a given area.

12.19.2. *Forest Types*

See also *For. Abstr.* 9 (Nos. 1436–7, 1496, 1955–7).

[1475]. 12.19.2 (494) : 04.4. ETTER, H. Vegetationskarte des Sihlwaldes der Stadt Zürich. [**Vegetation map of the Sihlwald of the city of Zürich.**] *Beih. Z. schweiz. Forstver.* No. 24, 1947. pp. 22 + map. [G.f.] Map and accompanying text [cf. *For. Abstr.* 8 (No. 939)].

[1476]. 12.19.2 (498) : 11.49. GEORGESCU, C. C., and CONSTANTINESCU, N. A. Tipurile naturale de pădure din regiunile şesurilor joase şi înalate ale Olteniei. [**Natural forest types in the low and high plains of Oltenia.**] *Rev. Pădurilor* 57 (12), 1945 (277–93 + tbls.). [Rum.f.]

The forest types of this part of Rumania are regularly determined by altitude and soil type. The following regions are described:—

(1) The flood plains of the Danube and Jiu rivers where the dominant forest type is composed of Willow and Poplar; also sand dunes, partly moving and partly fixed. Chernozem soils have developed on the dunes fixed in the quaternary period, on which *Quercetum pedunculiflorae* arose as a paraclimax, but this type has now almost disappeared and is partly replaced by plantations of *Robinia*. (2) Steppe or chernozem soils with the same vestigial paraclimax as (1) occupying sandy, azonal formations. (3) Slightly degraded chernozems formed on clay, on which the dominant type is *Quercetum pubescentis*. (4) Degraded chernozems with *Quercetum pedunculiflorae* except on northern slopes where there are slightly podzolized brown-red forest soils covered with *Querceto - pedunculiflorae — Aceretum - campestris*. (5) Brown-red forest soils formed on clay, at elevations between 100 and 140 m., with a forest climax of *Quercetum cerris* in which the dominant species are *Quercus cerris* and *Q. frainetto*. (6) At altitudes between 100–180 m. and 300–320 m. are found brown-grey forest soils, which represent a further stage in the podzolization of the brown-red forest soils and carry forest of the *Quercetum frainetti* type, consisting of 60–90 per cent. of *Quercus frainetto* and the remainder *Q. cerris*. (7) Plateaux with strongly podzolized brown-red forest soils with *Quercetum polycarpiceae* as the dominant type. The various types are illustrated by profiles and the different ground floras are enumerated.

[1477]. 12.19.2 (498) : 12.26–8 : 22.82. GEORGESCU, C. C. Ceretele ca tip de pădure. [**Pure stands of *Quercus cerris* as a forest type.**] *Rev. Pădurilor* 53 (8/9; 10/11), 1941 (444–57; 505–18). [Rum.g.]

[1478]. 12.19.2 (498) : 12.26–8 : 11.11.2. GEORGESCU, C. C. Considerațiuni asupra răspândirii cerului şi efectele gerurilor în cereturi. [**The distribution of *Quercus cerris* and the effects of frost on [pure] stands.**] *Rev. Pădurilor* 53 (4), 1941 (197–203). [Rum.g.]

[1479]. 12.19.2 (498) : 12.26–8. MORARIU, I. Asupra ecologiei şi sociologiei lui *Quercus pedunculiflora* Koch. [**The ecology and sociology of *Quercus pedunculiflora* [in Rumania].**] *Rev. Pădurilor* 56 (10/12), 1944 (257–67). [Rum.f.]

[1480]. 12.19.2 (498) : 12.26–8 : 23.3 : 24.4. CONSTANTINESCU, N. A. Stejarul pufos în Oltenia. [***Quercus pubescens* in Oltenia.**] *Rev. Pădurilor* 57 (10/11), 1945 (215–24) [Rum.f.]

This species is generally regarded as being of little economic or silvicultural importance, owing to the scanty yield and poor quality of timber from existing stands. The author of this article demonstrates that the present state of these stands is due to external biological factors and that in suitable conditions *Q. pubescens* can attain dimensions equal to those of other Oaks. The distribution of, and forest types formed by, this species in the Rumanian province of Oltenia are described in some detail. It is particularly successful in supporting the difficult conditions of the steppe and presteppe, and is to be recommended for the rehabilitation of the degraded forests of those regions and for shelterbelts.

[1481]. 12.19.2 (666.8 : 672) : 12.19.4 : 12.26–8 : 23.23:1. AUBRÉVILLE, A. Les brousses secondaires en Afrique équatoriale: Côte d'Ivoire, Cameroun, A.E.F. **[Secondary bush in equatorial Africa: The Ivory Coast, Cameroons, and French Equatorial Africa.]** *Bois For. Trop.* No. 2, 1947 (24–49). [F.]

The secondary bush which normally springs up in forest clearings or abandoned agricultural land has been estimated at 50–75 per cent. of the forest area in the Ivory Coast, Cameroons and French Equatorial Africa, but has been very little studied. The author reports on an intensive study of a dozen sample plots of secondary bush in different parts of this area, and reproduces a detailed inventory and profile of each of them. The first phase in the genesis of secondary bush is the establishment of numerous seedlings, many of which are of species not found in the original stand. The most remarkable of these characteristic light-demanding species is *Musanga smithii*, which often forms dense stands in a very short period, though no seed tree is to be found within a wide area. In 4 sq. m. of forest soil removed to a depth of 5 cm. from a primitive stand containing no *Musanga*, and sifted—a delicate process, owing to the smallness of the seeds—the author recovered 498 seeds. In about 10 years the typical light-demanding species of the secondary bush rapidly attain their maximum height of 15–20 m., which marks the end of the first phase. In the second phase an understorey develops of the same shrubby species as occur in the primary forest. A second group of tree species then establishes itself; these are still light-demanders, often with soft wood, but of slower growth than the species of the first phase, which they eventually overtake and dominate, attaining a height of 30–40 m. In the third phase the secondary species of the first phase have disappeared, those of the second phase have reached their full development, and the slower-growing, shade-tolerant species of the primary forest gradually grow up under them. Although the principal secondary species are very widely distributed, being found all over tropical Africa, they are very unequally distributed, and it is almost impossible to tell in advance what species will compose the secondary bush or whether the secondary bush, if cut down, will be succeeded by the same species. It is, for example, extremely difficult to obtain natural regeneration of a pure stand of *Musanga smithii*. The need for intensive research on the silviculture of these forests is emphasized. [Cf. *For. Abstr.* 9 (No. 1420).]

[1482]. 12.19.2 (669) : 12.26–8. ROSEVEAR, D. R. **Mangrove swamps.** *Fm. & For.* 8 (1), 1947 (23–30 + plates).

An account of the formation, soils, composition, animal life, uses, and possible conversion to true forest of Mangrove swamps in general and those of Nigeria in particular. In Nigeria there are only three true swamp species, of which one, the Red Mangrove (*Rhizophora racemosa*) occupies at least 99 per cent. of the area. Of the other two, the White Mangrove (*Avicennia nitida*) is also a tree, but the third, *Laguncularia racemosa*, is only a shrub in Nigeria. Details are given of dimensions, age, and reproduction of all three species.

[1483]. 12.19.2 (669) : 91.4 : 13.2. KEAY, R. W. J. **Forest vegetation in the savannah regions of Nigeria.** Forest Department, Nigeria. 1947. pp. 6 + plate. (Fifth British Empire Forestry Conference, Great Britain, 1947.)

A preliminary survey of the patches of high forest which occur in the savanna regions of Nigeria. [cf. *For. Abstr.* 8 (No. 2322)], with an additional note on the distribution of *Glossina palpalis* and *G. tachinoides*.

[1484]. 12.19.2 (7) : 12.26–8 : 09.2. BRAUN, E. L. **Development of the deciduous forests of Eastern North America.** *Ecol. Monogr.* 17 (2), 1947 (211–9).

[1485]. 12.19.2 (798) : 12.19.4 : 11.62.21 : 11.41.1. RAUP, H. M. **Forests and gardens along the Alaska highway.** *Geogr. Rev.* 35 (1), 1945 (22–48). O.G.

Preliminary report of geological and botanical investigations carried out along the Alaska Highway between Dawson Creek and Whitehorse during the summer of 1943. The forest types are discussed in detail. It is concluded that stands of Aspen (*Populus tremuloides*) and Lodgepole Pine (*Pinus contorta* var. *latifolia*) owe their abundance to fire and do not reproduce themselves once they reach maturity. The four other principal forest species, White and Black Spruce (*Picea glauca* and *P. mariana*), Alpine Fir (*Abies lasiocarpa*) and Balsam Poplar (*Populus tacamahaca*) are the most mesophytic species in the region and the first three reproduce themselves, in the absence of fire, generation after generation on the same site. The affinities of the various types with other forests of the north-west are discussed. Observations of the effects of clearing, fire, and local topography, together with the general similarity of soils and surfaces to those under prairie further to the east and south, suggest that at least part of the vegetation on heavy clay soils along the Highway is not far removed from prairie and that if the water-table were lowered the Black Spruce type might immediately give way to some kind of grassland. Presumably the water-table is held up by a permanently frozen subsoil, so that a drier climate might not be necessary to lower the ground water if the climate were warm enough to lower the permafrost table. If this hypothesis is correct it should be possible to produce a grassland simply by removing the existing vegetation and thus lowering the frost table.

12.19.3. *Other Vegetation Types*

[1486]. 12.19.3 (548.7) : 23.3 : 23.22. ROSAYRO, R. A. DE. **The montane grasslands (*patanas*) of Ceylon: an ecological study with reference to afforestation.** *Trop. Agriculturist, Ceylon* 101 (4), 1945 (206–13 + plates); 102 (1–3), 1946 (4–16; 81–94; 139–48 + plates). L.S.

12.19.4. *Succession*

See also *For. Abstr.* 9 (Nos. 1564–6, 1876).

[1487]. 12.19.4 (744) : 12.25 : 23.4 : 11.2. LEOPOLD, A. C. **The distribution of Red Cedar in Eastern Massachusetts.** *Rhodora* 49 (583), 1947 (172–5). O.B.D.

The plant succession of old fields to Oak/Hickory stands of the Central Hardwoods type originally covering most of Connecticut, Rhode Island and the eastern margin of Massachusetts, is said to have had an initial stage of Red Cedar and Gray Birch. Old fields in central Massachusetts commonly come up to White Pine, which later gives way to the Transition Hardwoods characterized by Red Oak, White Ash, Sugar Maple, Red Maple and Black Birch. The approximate boundary in eastern Massachusetts between old fields which come up to Red Cedar (*Juniperus virginiana* var. *crebra*) and those that come up to White Pine has been mapped and a small section analysed in considerable detail. A map shows that the frequency distribution of Red Cedar, as shown by isopleths has remarkable similarities in pattern to isotherms of no fewer than four cold weather phenomena.

12.2. *Special (Systematic) Botany*

See also *For. Abstr.* 9 (Nos. 1470–1, 1502, 1544).

[1488]. 12.2 (669). JONES, A. P. D. **Botanica Nigerica.** *Fm. & For.* 8 (1), 1947 (10–16).

A short historical account of botanical studies in Nigeria.

12.25-9. Spermatophyta

[1489]. 12.25–9 : 01.2. **Index Kewensis plantarum phanerogamarum. Supplementum decimum.** Clarendon Press, Oxford. 1947. pp. 251.

[1490]. 12.25–9 (51). HAO, K. S. **The genera of Chinese woody plants.** Chung Hwa Book Co., Shanghai. 1945. pp. 244. [Chin.] *Abstr.* in *Trop. Woods* 91, 1947 (51).

Consists mainly of a key for identifying genera and species.

[1491]. 12.25–9 (75 : 76) : 3. HARRAR, E. S., and HARRAR, J. G. **Guide to southern trees.** Whittlesey House, McGraw Hill Book Company, Inc., New York. 1946. pp. ix + 712. Price $4.50 (22*s.* 6*d.*).

The book describes the more than 350 arborescent species indigenous to that region

of the United States lying south of the Mason-Dixon line, the Ohio River, and the extension of the Missouri-Arkansas boundary to the western limits of southern forests. Minimum use is made of technical terminology. Included are notes of unusual and historical significance on many of the trees described, together with information on the use of valuable products, other than lumber, derived from the leaves, flowers, fruit, wood or bark of all of them. There are 201 plates and a bibliography of 81 references. *From authors' preface.*

[1492]. 12.26–8 (498). GEORGESCU, C. C., MORARIU, I., and CREȚOIU, P. Contribuțiuni la studiul speciilor de *Quercus* în România: *Q. virgiliana* Ten. [*Quercus* **species in Rumania:** *Q. virgiliana.*] *Rev. Pădurilor* 54 (3/4), 1947 (97–104). [Rum.g.]

Cf. *For. Abstr.* 9 (Nos. 1476–80).

[1493]. 12.26–8 : 12.19. HUTCHINSON, J. B. **Notes on the classification and distribution of genera related to *Gossypium*.** [*Cienfugosia, Gossypioides, Thespesia, Kokia, Notoxylinon, Alyogyne.*] *New Phytol.* 46 (1), 1947 (123–41). O.B.D.

13. FOREST ZOOLOGY

13.1. *General Zoology*

See also *For. Abstr.* 9 (Nos. 1473–4, 1482–3, 1626, 1897 *et seq.*).

[1494]. 13.15 : 13.2 (410). IMMS, A. D. **Insect natural history.** *New Naturalist Series.* Collins, St. James's Place, London. 1947. pp. xviii + 317 + 72 plates. Price 16*s.*

[1495]. 13.15 : 13.2 : 45.3. BRUES, C. T. **Insect dietary: an account of the food habits of insects.** Harvard University Press, Cambridge, Mass. 1946. pp. 466. Price 27*s.* 6*d.*

Includes chapters on abundance and diversity of insects; types of food habits—their relation to structure and environment; herbivorous insects; gall insects; fungi and microbes as food—symbiosis with micro-organisms; predatory insects; parasitism; blood-sucking insects and other external parasites; entomophagous and other internal parasites; insects as food for man and other organisms. The bibliographies appended to each chapter total more than 190 pages.

2. SILVICULTURE

See also *For. Abstr.* 9 (No. 1972).

[1496]. 2 : 02.1 : 12.19.2. DENGLER, A. Waldbau auf ökologischer Grundlage. [**Silviculture on an ecological basis.**] Springer-Verlag, Berlin. 3rd. (rev.) ed., 1944. pp. 596. [G.]

The third edition of this well known textbook differs from its predecessors of 1930 and 1935 only in having been slightly enlarged and revised to bring it into line with the more recent literature; the principles of the author's exposition and the whole arrangement of the subject matter remain the same.

[1497]. 2 (757) : 3 : 4. **Handbook of standard forestry practices for South Carolina.** Forestry Committee of South Carolina. 1944. pp. 72.

[1498]. 2 : 12.26–8 (471) : 32 : 33.15.1 : 47. APPELROTH, E. Om björken och dess skötsel i Finland intill senaste världskrig. [**Birch and its silviculture in Finland up to the last world war.**] *Norrlands SkogsvFörb. Tidskr.* 1946 (3), (331–90). [Sw.] LAPPI-SEPPÄLÄ, M. Om den rationella skötseln av björkeskogar i Finland. [**The rational silviculture of Birch woods in Finland.** *Tidsskr. Skogbr.* 55 (4/5), 1947 (154–64). [Sw.]

Birch, the pioneer tree species in Finland after the glacial period, has been much favoured in comparison with the longer-lived conifers by the traditional practice of felling and burning forest for temporary agriculture, which persisted—especially in E. and central districts—into the 20th century and was not finally prohibited by law until 1928. At present, the economic limit of Birch in this country is at roughly 65° N. lat. To the S. of this line the standing volume of Birch, according to the forest survey of 1936–38, was 204 million cu.m. over bark (19·2 per cent. of the total growing stock for all species), with an annual increment of 7·64 million cu.m. under bark (20·9 per cent.

of total increment). The great rise in demand and prices for Birch that accompanied the development of the veneer and plywood industry is discussed with special reference to the concurrent increase in tolerance of lower grades of logs and the utilization of lower-grade material for cores, etc. The defects of peeler logs are in the main remediable by good silviculture, and present log values could probably be doubled by proper tending operations. The commonest defects are knots, crooked or excentric growth, 'black rot' due to *Fomes nigricans*, and checking (often caused by the weight of snow on thicket stands, and formerly by bark-stripping, which is also responsible for patches of hard, brittle wood beneath the stripped areas). Risk of damage by black rot is always present if water can penetrate under the bark, e.g. through branch stubs or open wounds. Other fungi, and insects as a whole, are generally of minor importance, except for colour defects produced by the larvae of *Dendromyza betulae*. As the outer, later layers of wood determine quality, and rapid growth is a decisive factor, the growing of Birch as a crop should be confined to the better, moist sites, rich in nutrients. The best wood is produced in mixed Birch and Spruce of uniform growth, e.g. where the former has regenerated between Spruce seedlings and has been forced by competition to grow more slowly, thus making the best use of the Spruce's ability to aid natural cleaning of the stems. On open ground Birch regularly overtops the Spruce, which is relegated to the lower storey but will take over when the Birch is felled.

Dense Birch in the thicket stage is very susceptible to snow damage and needs early cleaning. The first thinnings must be cautious, but all whips and suppressed trees should be removed, since they react poorly to release. When natural pruning extends to a good butt length, up to 600 main crop trees per ha. (though it is seldom that so many are available) are selected for pruning (of dead branches only). A pruning team usually consists of two men, the first removing the branches within reach of a pole 2·5 m. long and the second those within reach of a 4·5 m. pole (both provided with the pruning saw devised by the Finnish Forest Research Institute), while a boy marks the trees with oil paint. It is a great advantage if the trees are first selected and marked by trained staff. Pruning, which pays only for good trees on good sites, should be done during the period of rapid increment and preferably in summer.

After pruning, the crop trees must be heavily thinned for rapid diameter increment. Older stands that have remained closed seldom respond to heavy thinning, as Birch needs an even development to maintain good increment. Marking should be done in summer, when crown development is most readily assessed, and special attention must be paid to the quality of the stems.

The rotation is about 70 years. In mixed stands the Birch is usually ready for final fellings, and its removal provides a heavy thinning, at a time when the conifers need the additional room. Properly treated mixtures, particularly with Norway Spruce (which is the natural successor to Birch on the better sites), have advantages in both quality and outturn on the one hand and improvement of the forest microclimate and soil on the other.

Regeneration of pure Birch has been severely restricted by the prohibition of clearing and burning for agriculture, and a change of species is almost inevitable in the absence of burning. On the better sites the trend is to convert to Norway Spruce, which comes in naturally where seed is available and is planted or sown after Birch elsewhere. An admixture of Birch is welcomed and is readily obtained by suitable felling practice. Where Birch has to be planted, e.g. in groups on restricted areas, 2-year-old seedling or 3-year transplant stock can be used. Young mixtures need careful treatment to avoid whipping and suppression of the conifers by the Birch.

As most Birch is floated to the mills, about 80 per cent. of the total cut is felled in summer, using transpiration from the intact crowns to reduce wood density sufficiently to ensure buoyancy [cf. *For. Abstr.* 9 (No. 1654)]. Trimming and crosscutting are done in late autumn, before the snows. In marking, felling and conversion all possible care must be taken to prevent injuries to the bark, which cause degrade.

Of the taxonomic forms concerned (*Betula verrucosa*, *B. pubescens* and intermediates), the *verrucosa* types are much the most important economically and should be favoured on good sites.

[1499]. 2 : 12.26–8 (485) : 23.23 : 23.26. ARNBORG, T. Insamling och sådd av björkfrö samt några synpunkter på björkskogsskötsel. **[The collection and sowing of Birch seed, with notes on the silviculture of Birch.]** *Skogen* 34 (18), 1947 (243–5). [Sw.]

Cf. *For. Abstr.* 8 (No. 1006). In Sweden Birch seed generally ripens in August; that of *B. verrucosa* is earlier, often by as much as a fortnight, than that of *B. pubescens*. If seed is collected from felled trees, the felling should immediately follow a rain, when the catkins are less liable to fall to pieces. As soon as they dry, the catkins are picked or shaken over a cloth on the ground. Seed not fully mature will not ripen after felling or collection. One large tree may yield as much as 10 kg., or 10 million seeds. Seed must be rapidly and thoroughly air-dried by spreading it in a thin layer in a dry place, after which it is stored for the winter either in a sealed container in a cellar or in bags in a dry but not necessarily frost-free place. Seedbearers for natural regeneration should be only the best trees, and few in number. Fire has a selective effect in favour of *B. verrucosa*, which, owing to its generally thicker bark and stems, survives better than *B. pubescens*. Seed of the former has larger wings and a better capacity for dispersal over long distances; the latter species, however, appears to be a more vigorous coppicer.

Nursery sowings are usually made in spring (May–June), but autumn sowings may also do well. *B. verrucosa* germinates better than *B. pubescens* in autumn sowings. The seedbed may be prepared either (*a*) by spreading and burning quantities of brushwood, and sowing in the ashes; or (*b*) by deep digging, adding layers of 5–6 cm. of well rotted manure, 3–4 cm. of charcoal breeze, 5–6 cm. of fine earth, and superphosphate and potash at respectively 25 and 15 kg./are, mixing all these with the upper layers of the original nursery soil, compacting, and watering if the soil is dry. Sowings are made broadcast or in drills, using 10–20 g. of seed per sq. m., and covering with 1 mm. of fine sand or finely divided leaf compost. Birch has a rather high phosphate requirement, 2-year-old stock needing more phosphate than grain crops. In the second year, calcium nitrate may be given at 4 kg./are. Watering must be done to prevent the surface soil drying out in the first summer. Germination often takes more than a month. The stock is transplanted after 1 or 2 years, and planted out as 1/1, 1/2, 2/1 or 2/2 stock, according to its development and the nature of the planting site.

The best planting methods, especially on grassy or moist sites, are ordinary pit planting and planting on inverted turves, though where small plants are used on relatively weed-free sites, crowbar planting suffices. On drier sites, and in mixture, *B. verrucosa* shows better growth than *B. pubescens*; on wetter sites its behaviour remains uncertain. Of the 'Grey Birch' bark type [cf. *For. Abstr.* 9 (No. 1468)], which appears to be associated with high timber quality, the best trees as regards yield belong under *B. verrucosa*. Another bark type, the '*flarnbjörk*', which has excellent timber, appears always to be a *B. pubescens* type of relatively poor growth rate. The flamy and curly types of figured Birch belong under *B. verrucosa*.

Brief notes are included on tending operations. [Cf. preceding abstract.]

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

See also *For Abstr.* 9 (Nos. 1459, 1480–1, 1722).

[1500]. 21 : 12.25 (485) : 23.51. NORDIN, E., and HAMILTON, H. Är enen till skada eller nytta i skogsmarkerna? **[Is *Juniperus communis* harmful or useful on forest lands?]** *Skogsägaren* 23 (5), 1947 (83–6). [Sw.]

Nordin believes that different opinions on this question arise from differences in regional and local climate, especially in rainfall. In the dry E. and interior of Sweden, Juniper is usually regarded as a weed, and in artificial regeneration, clearing of all Juniper is often prescribed. In the wetter central and S.W. districts, this species is valued for the suppression of weed growth and the protection afforded to seedlings. The soil under Juniper is very good and is valued for potting mould. On suitable sites, Juniper is well worth retaining to fill out plantations and, if plentiful, it will enable the planting espacement to be increased. It would be difficult, however, to justify its retention in the case of direct sowings on rather dry ground.

Hamilton emphasizes that, besides affording protection to young plants and excellent seedbed conditions, Juniper is valuable as cover and

food for birds and animals. His advice is to cut only the bushes that must be cut and to prune the remainder to a suitable height, when they will in time yield excellent stakes, fence posts, etc.

[1501]. 21 : 12.26–8 (729.1) : 23.24. ROIG, J. T. El cedro. Estudio ecológico de las plantaciones existentes y recomendaciones para la propagación y el cultivo comercial. [**Cedar.** [*Cedrela mexicana.*] **Ecological studies of existing plantations and recommendations for propagation and commercial cultivation.**] *Bol. Estac. exp. agron. Cuba* No. 64, 1946. pp. 47. [Span.]

A study of the more important plantations in Cuba. [Cf. *For. Abstr.* 8 (No. 236).]

[1502]. 21 : 12.26–8 (676) : 31.0. GREENWAY, P. J. **Mahogany in East Africa. I. The *Khayas*.** *E. Afr. agric. J.* 13 (1), 1947 (8–14).

Notes on botanical and silvicultural characters and properties of timber of *Khaya anthotheca*, *K. grandifoliola*, *K. nyasica*, and *K. senegalensis*.

[1503]. 21 : 12.26–8 (481) : 12.11.3. BARTH, A. Aspen, dens kultur og behandling for kvalitetsproduksjon. [**Aspen** [***Populus tremula***], **its cultivation and treatment for the production of high-grade timber.**] *Publ. Ingeniør F. H. Frølichs Fond for Aspeskogbrukets Fremme* No. 1, 1942. pp. 87. [Nor.] Grøndahl and Søns Boktrykkeri, Oslo. Price Kr. 4.

A practical summary of available information under the headings:—Aspen as a forest tree in Norway; its general silvicultural characters; yield and financial returns; requirements of match factories for its timber; the raising of Aspen and other Poplars from seed; stimulation of seed production; vegetative propagation; establishment of nurseries; planting out; treatment of Aspen woods; natural regeneration; pruning; exotic *Populus* spp. and their hybrids with Aspen; mutations and crosses; propagation of *Populus* spp. by cuttings; some *Populus* spp. worth trying in Norway; hybrid Poplars. There are 29 illustrations and a bibliography of 51 references. [Cf. *For. Abstr.* 9 (Nos. 1455, 1465).]

[1504]. 21 : 12.26–8 (77) : 23.1. ZEHNGRAFF, P. **Possibilities of managing Aspen.** *Lake St. Aspen Rep.* No. 21, 1947, pp. 23.

Aspen (*Populus tremuloides*) constitutes about 40 per cent. of the commercial forest area in the Lake States, but only about 15 per cent. of it is on good, and 54 per cent. on medium sites. Aspen on good sites lends itself to intensive management and responds exceptionally well to thinnings and early improvement measures. Aspen stands reproduce after cutting primarily through root suckers, which must have full sunlight in order to develop properly. It is essential that any unwanted cull trees should be removed at the time of final felling. Winter logging is more conducive than summer to sucker growth. Suckering can be stimulated by disking. [Cf. *For. Abstr.* 9 (No. 1531).]

[1505]. 21 : 12.26–8. SANTOS, J. C. DOS. Como en ví o Pau-Novo no Estado de Minas-Geraís. [***Sessea brasiliensis* in the [Brazilian] State of Minas-Geraís.**] *Chacaras e Quint.* Oct. 15, 1946 (431–4). *Abstr.* in *Agron. trop.* 2 (7/8), 1947 (434).

The author considers that *Sessea brasiliensis*, a species of Solanaceae, would be a useful species for afforestation, capable of rivalling the Eucalypts in rapidity of growth. It can attain a height of 20 m. and a diameter of 50 cm. even in poor soils, is easy to propagate either by direct sowing or by planting, and produces timber of a good quality.

21.0. *Adaptability to the General Environment. Acclimatization*

[1506]. 21.0 (46) : 12.26–8. ARANA SANTOYO, M. M. DE. La *Acacia melanoxylon* R.Br. en Galicia. II. Estudio de los principales agrupaciones de *Acacia melanoxylon*. [***Acacia melanoxylon* R.Br., in Galicia. II. Study of the principal stands of *A. melanoxylon*.**] *Montes, Madrid* 2 (12), 1946 (550–60). [Span.]

A detailed study of the most important stands of *Acacia melanoxylon* in Galicia and of the climate, topography, soil and vegetation of the districts where they are found.

[1507]. 21.0 (46) : 12.26–8 : 21. ARANA SANTOYO, M. M. DE. La *Acacia melanoxylon* R.Br., en Galicia. III. Caracteres selvícolas de la *A. melanoxylon*. [***Acacia melanoxylon* R.Br., in Galicia. III. Silvicultural characteristics of *A. melanoxylon*.**] *Montes, Madrid* 3 (13), 1947 (59–70). [Span.]

In Spain *Acacia melanoxylon* finds conditions nearest to those of its natural habitat, in the coastal region of Galicia. It requires a temperate or warm-to-temperate, humid climate without sudden changes of temperature, and a siliceous or siliceous-clay, fairly damp soil, preferably of granite, gneiss or alluvial origin, along with plenty of humus. Although the tree can live at various elevations, the author considers 700 m. the limit for good development. It is moderately light-demanding and although preferring the shelter of valleys, is wind-resistant. It regenerates readily under favourable conditions, i.e. in the open or where lightly shaded. An account of its appearance and main characteristics is given. An analysis was made of 6 Galician trees to find variations in diameter, height and volume in relation to age, but the results cannot be taken as characteristic of the species as a whole. *A. melanoxylon* grows pure or in mixture. In Galicia it forms mixed stands with *Eucalyptus globulus* and *Pinus pinaster*, but the author believes that, where conditions are favourable, it will in time dominate these species; and that the formation of pure, regular stands is preferable.

Felling systems and cycles are discussed, but no experiments have so far been made in the, as yet immature, Spanish stands.

[1508]. 21.0 (485) : 12.26–8. WIJKSTRÖM, S. Poppeln som skogsträd. [**Poplar as a forest tree.**] *Skogen* 34 (20), 1947 (267–8). [Sw.]

Cuttings of *Populus robusta*, imported from Belgium in 1944, have been propagated in the Jönköping district. Plantations at Mykinge, between Jönköping and Gränna, are so far doing well. Neither in nurseries nor in plantations has there yet been any trouble from spring frost or winter cold. At Mykinge some 1/0 stock was planted out in spring 1945 on a site, formerly under conifers with Birch, which had been felled in the previous winter and the slash piled and burnt. Poplars on the sites of the fires have grown the most vigorously; one such plant was 6·1 m. tall and 5·7 cm. in diam. in September 1947. Wijkström suggests that a suitable spacing for *P. robusta* in Sweden would be 7×7 m., and that an understorey of shadebearers, e.g. Norway Spruce and/or Alder, would be advantageous. The Poplar rotation would probably be 30–35 years, and, with careful felling, sufficient of the understorey should remain as a crop to be felled after a further 20–30 years.

[1509]. 21.0 (669) : 12.26–8 : 23.2. WATTERS, J. R. G. **Neem in Sokoto Province.** *Fm. & For.* 8 (1), 1947 (31–2).

An account of the successful acclimatization of Neem (*Melia azadirachta*) in Sokoto Province, Nigeria. Introduced 16 years ago, it is now the most successful shade and fuel tree in the province. The technique now used is to collect the fruit locally in June and dry it completely in the sun. The seed is then sown in the nursery at the beginning of September. Natural regeneration usually comes up freely under the shade of the older trees and is transplanted to fill up blanks. No watering is necessary after the rains have stopped. Plants are left one year in the nursery and put out usually from the latter part of June. Stumping is not normally done, but the leaves are generally removed to prevent excessive transpiration. Neem will grow in most kinds of soil and thrives better than most species on dry, stony, shallow soil with waterless subsoil, or in places where there is a hard calcareous or clay pan not far from the surface. Another point in its favour is that it is not attacked by *Loranthus* spp. which have prohibited the further use of *Dalbergia sissoo*.

[1510]. 21.0 (798) : 12.25 : 23.3. BRUCE, D., and COURT, A. **Trees for the Aleutians.** *Geogr. Rev.* 35 (3), 1945 (418–23). O.G.

A short account of the climate of the Aleutian Islands, the slow spread of forest on Kodiak Island, and the not very successful attempts of the American army to plant trees there during the war. The only species of which a proportion survived after a year was Sitka Spruce.

[1511]. 21.0 (931). BARNETT, M. J. **The history and development of tree planting in Canterbury.** *J. N.Z. Inst. Hort.* 16 (1), 1946 (1–22). L.S.

Records show that the first plantings on the plains in the neighbourhood of Canterbury, N.Z. consisted mainly of European trees, Oak, Elm, Ash, Willows, Poplars, etc. These were followed by Eucalypts and later by *Pinus radiata* and *Cupressus macrocarpa*. Larch, Douglas Fir, Redwood, Wellingtonia and the Spruces have proved unsuitable for the plains in general, but have succeeded on the down

country, the foothills and the higher country especially where a heavier rainfall is experienced. Up to the present all attempts at afforestation have been confined to waste and useless land and no attempt has been made to grow, e.g. Oak and Ash on better-class land and under approved silvicultural control. A few years ago the golden scale [*Asterolecanium variolosum*] threatened the extinction of the European deciduous Oaks, but has been brought under control by the parasite *Habrolepis dallii*. *P. radiata* is the most useful all-round tree to be grown in New Zealand. Where the average annual rainfall exceeds 30 in., Douglas Fir is worth growing. *C. macrocarpa* is a useful tree for general farm purposes; some of the Australian gums, *Eucalyptus macarthuri*, *E. regnans* and *E. obliqua* do well in some situations. *Cedrus atlantica* and *C. libani* for dry, exposed, hill sites, and *C. deodara* for valleys, are recommended as valuable trees for producing high-quality timber. The Sequoias are recommended for valleys and sheltered places. Oak and Ash will do well on the heavier soils.

[1512]. 21.0 (94) : 12.25 : 11.21. PRESCOTT, J. A., and LANE-POOLE, C. E. **The climatology of the introduction of Pines of the Mediterranean environment to Australia.** *Repr.* from *Trans. roy. Soc. S. Aust.* 71 (1), 1947 (67–90).

The species under consideration are *Pinus radiata*, *P. canariensis*, *P. pinaster*, *P. nigra*, and *P. halepensis*. The temperature and rainfall of their natural habitats in a Mediterranean environment are discussed in some detail, and Australian homoclimes for each species are shown on maps. The results of plantations of these species in Australia are summarized. Rainfall, more than temperature, limits the distribution of *P. radiata* beyond its optimum sites, seasonal distribution of rain being of special importance. Whilst 30 in. and over of rain are desirable, good results have been obtained with a winter rainfall of 22–25 in. *P. pinaster* has succeeded, well outside its climatic belt, in Western Australia, and in South Australia on soils unsuited to *P. radiata*. The Portuguese race is greatly superior to others. *P. canariensis* and *halepensis* promise well against wind erosion in many parts of the lower-rainfall areas, and for planting on very poor, steep slopes where water erosion has occurred. *P. nigra* appears to be climatically exotic but it may be useful in New South Wales for breaking up large areas of *P. radiata*, like *P. pinaster* in South Australia.

[1513]. 21.0 : 12.26–8 : 31.0. MOULDS, F. R. **Eucalypts and their use in semi-tropical plantings.** *Trop. Woods* No. 91, 1947 (1–16 + plates).

The author gives (1) a review of the recent literature on Eucalypts as exotics; (2) suggestions for future plantings; (3) a use-classification of Eucalypt timbers; (4) some short silvicultural notes.

21.1. *Light and Temperature Requirements*

[1514]. 21.1 : 12.25 (481) : 12.11.12 : 12.11.13 : 12.11.23 : 42.21. HAGEM, O. **The dry matter increase of coniferous seedlings in winter: investigations in oceanic climate.** *Medd. Vestland. forstl. Forsøkssta.* 8 (1), (Ser. 26), 1947. pp. 317. [E.e.nor.]

A full report on investigations carried out from 1935–45 in order to test Printz's theory that the western coniferous tree limit in Norway is conditioned by light deficiency coupled with excessive warmth in winter, which causes seedlings to lose more dry matter by respiration than they can make good by transpiration. The data are based on dry-matter determinations of seedlings made periodically during the season October–March inclusive. The roots, stems and needles were weighed, dried, burned and reweighed separately. The results of the studies are adverse to Printz's hypothesis that the mild, wet months of early winter are critical and that the negative balance of dry matter chiefly belongs to this season. In fact, the period September–November showed a marked positive dry-matter balance, but this is largely concentrated in the roots, which make strong growth at that period, and analysis of the aerial parts of a plant alone will therefore give erroneous results. In the later part of November and early December, the roots have a growth pause and the products of photosynthesis remain in the needles, which consequently often show a considerable dry-matter increase in November. As a rule December showed the least increase in dry matter, and occasionally even a slight loss. This agrees with the work of Ålvik on assimilation and

respiration; he too showed that the critical period is a few weeks in the darkest time about the winter solstice. From the end of January the increasing light usually leads to a considerable production of dry matter. The brown scorching which occurs in February and March in nurseries is due to desiccating winds and insolation and has nothing to do with preceding loss of dry matter.

On the whole, it was found that reduced lighting was not as detrimental to seedlings as has been supposed. Seedlings were grown under reduced lighting of various intensities from 20 to 60 per cent. of full daylight. Even seedlings which had only 20 per cent. of daylight throughout the summer were quite sound and frost-hardy during the following winter, though they suffered from frost-heaving owing to their poorly developed roots. Seedlings of frost-sensitive Sitka Spruce from Queen Charlotte Island were grown under screens for two consecutive years. Under 70 and 50 per cent. light the plants suffered no damage and wintered well, with only slight frost injury. This was the case also with plants grown under 30 per cent. light, but these were rather small and suffered from frost-heaving. Controls grown in open beds with full daylight and no screens were all destroyed by frost and heaving.

The final chapter gives a detailed account of Ålvik's method of determining compensation light (i.e. the illumination necessary to compensate by photosynthesis for 24 hours of respiration loss) for young Pine and Spruce. [Cf. *For. Abstr.* 2 (189–90).]

21.3. *Soil Requirements*

See also *For. Abstr.* 9 (Nos. 1446, 1863–7).

[1515]. 21.3 : 11.4 : 12.11. LEYTON, L. **Soil conditions and tree growth. I. Physiological aspects of the tree soil complex.** *Chem. & Ind.* No. 37, 1947 (558–60). P.R.

21.6. *Growth Form. Habit. Tree Classes*

See also *For. Abstr.* 9 (No. 1570).

[1516]. 21.61 : 31.27 : 01.7 : 52.3. ESSER, M. H. M. **Tree trunks and branches as optimum mechanical supports of the crown. I. The trunk.** *Bull. math. Biophys.* 8 (2), 1946 (65–74). L.S.

It is shown that an inclined regular growth of tree trunks under the action of prevailing winds may be explained as a response of the plant to the mechanical action of the wind, in conformity with the Schwendener theory of shape of plants, based on the concept of maximum strength. A possible mechanism of such response is suggested. The condition of maximum strength determines the inclination of the tree trunk on the basis of purely mechanical considerations. A numerical example computed for a Palm agrees with observational data. *Author's summary.* [Cf. *For. Abstr.* 8 (No. 185).]

[1517]. 21.61 : 31.27 : 01.7 : 52.3. ESSER, M. H. M. **Tree trunks and branches as optimum mechanical supports of the crown. II. The branches.** *Bull. math. Biophys.* 8 (3), 1946 (95–100). L.S.

Using assumptions made in a previous paper, a theory of the shapes of primary branches is developed. Two cases are studied; a primary branch which has a portion denuded of secondary branches, and a primary branch with a continuous load of secondary branches. The first case leads to hyper-elliptic integrals, the second to polynomials of second degree. *Author's summary.*

[1518]. 21.61 : 12.26–8 : 12.12 : 12.11.3. MEYER, K. A. Süntel-, Renk- und Studbuchen. **[Gnarled, twisted, and stunted Beeches.]** *Schweiz. Z. Forstw.* 98 (4), 1947 (169–75). [G.]

A brief review or annotated bibliography of literature dealing with several types of Beech of peculiar form, which have been held by some authorities to be separate races, and by others to result from adverse climatic or edaphic conditions.

21.8. *Phenology*

See *For. Abstr.* 9 (Nos. 1467, 1941).

21.9. *Longevity*

See also *For. Abstr.* 9 (No. 1938).

[1519]. 21.9 (73). LAUGHLIN, K. **Big trees of the Midwest.** *Amer. Midl. Nat.* 37 (3), 1947 (788–96).

Includes a list of some 125 species, with location and dimensions of the largest specimens

of each found by the author in the middle west of the U.S.A.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.1. *High Forest Forms*

See also *For. Abstr.* 9 (Nos. 1430, 1937).

[1520]. 22.12 : 12.26–8 : 23.1. DIACONU, I. Technica tăerilor de regenerare în regimul codru cu tăeri progresive şi posibilitatea pe volum. [**The technique of successive regeneration fellings in high forest and the calculation of yield by volume.**] *Rev. Pădurilor* 61 (9/10), 1946 (120–30). [Rum.f.]

[1521]. 22.13 : 22.83.2 : 12.25 : 12.26–8 (748). BURNHAM, C. F., FERREE, M. J., and CUNNINGHAM, F. E. **The White Pine/Oak forests of the Anthracite Region.** *Sta. Pap. Ntheast. For. Exp. Sta.* No. 8, 1947. pp. 35.

Describes the present condition of these forests and suggests methods of cutting which would help to restore them to their former condition. A shelterwood system is recommended.

[1522]. 22.14.1 (494) : 66. KNUCHEL, H. **Management control in selection forest.** *Tech. Commun. imp. For. Bur.* No. 5, 1946. pp. 32 + plates. Price 3*s.* 0*d.*

22.8. *Silvicultural Description of Forms of Stand*

[1523]. 22.83 : 12.25 : 12.26–8 (498). PASCOVICI, N. Dispariţia stejarului din parcela 61D., din ocolul silvic Frătăuţii Noui (Bucovina). [**The disappearance of Oak from compartment 61 D. in the forest circle of Frătăutii-Noui (Bukovina).**] *Rev. Pădurilor* 55 (7/8), 1943 (301–5). [Rum.f.]

The natural dominants in this region of Rumania are Pedunculate Oak, Silver Fir, and Beech; there is no Sprucc. An attempt was made 40–60 years ago to grow a mixture of Oak and Spruce, with the intention of extracting the latter by periodical thinnings while the Oak matured. In fact, the Spruce showed great vigour and rapidity of growth and, at the age of 60 years, has almost eliminated the Oak. The different rate of growth of the two species makes a mixture difficult though not impossible to establish.

23. FORMATION OF STANDS

23.1. *Natural Regeneration*

See also *For. Abstr.* 9 (Nos. 1520, 1540, 1874–5).

[1524]. 23.1 : 12.25 : 22.14.1. RĂDULESCU, A. V. Câteva observaţiuni în legătură cu regenerarea bradului. [**Some observations on the regeneration of *Abies alba*.**] *Rev. Pădurilor* 55 (11/12), 1943 (460–9). [Rum.f.]

Apart from the amount of light, regeneration of Silver Fir is affected by local conditions such as the nature of the forest floor and the aspect. A carpet of moss may be either favourable or unfavourable according to the species. For example, though seed germinates in a cover of *Hylocomium triquetrum*, seedlings die back after one year if the moss layer is more than about 10 cm. deep. On the other hand, *Hypnum crista-castrensis* and *Mnium undulatum* provide very favourable conditions. Aspect has a considerable influence on regeneration and north, north-west, and north-east aspects lead to important modifications in the manner of applying selection felling.

[1525]. 23.1 : 12.25 : 11.12. KOS, J. Přirozené osemenění lesních ploch lehkými létavými semeny. [**Natural seeding of forest areas by light, flying seeds.**] *Lesn. Práce* 26 (5), 1947 (155–72). [Cz.russ.]

The fall of a winged seed, taking Norway Spruce as an example, is considered as a problem in dynamics, and mathematical formulae are presented to express rate of fall and number of rotations per second in still air. A numerical example based on measurements of 100 very large Spruce seeds, gave results agreeing closely with observed values for the fall of a selected seed of average dimensions and weight, which fell at 75–78 cm./sec., rotating 24–27 times per sec. The critical air velocity below which the seed falls and above which it rises in the air, is calculated for the seed used as 1·8 m./sec., but the average Spruce seed probably has a somewhat lower critical air velocity.

Kos discusses air movements and seed dispersal with chief reference to differences in stand structure, e.g. between uniform managed woods and irregular natural forest, concluding that air movements most favourable to seed deposition require some irregularity of stand structure, and hence that, for natural regeneration, thinnings should be irregular, leaving

denser groups of trees in some places. Natural regeneration on the area occupied by the parent stand, cannot be expected in: (1) small isolated woods; (2) tongues of forest running into unwooded areas; (3) windward borders, to a depth of 200 m. and more, or marginal stands on plains; (4) marginal stands on windward slopes rising from open ground; (5) exposed windward slopes of hills within the forest; (6) N and S slopes with strong air currents; (7) the foot of steep slopes rising from valleys, and wind-exposed slopes of depressions; (8) unsheltered small clear fellings; (9) hot S and SW slopes, or borders of mature stands under the same conditions; (10) stands of uniform age and structure with broken canopy; (11) small estate forests, mature or nearly so and cut over annually.

Conditions favourable to natural seeding of the parent area are: (i) Shelter from wind afforded by topographical features; (ii) shelter afforded by the stands themselves, e.g. marginal zones to the leeward; (iii) down-currents over cool areas at the N and NE margins of stands in plains or on slopes of the same aspects at higher elevations; (iv) cool areas created by topographical features, e.g. depressions, transverse valleys, ravines; (v) stands where the tree crowns are contiguous for a large portion of their length, especially where non-uniform thinnings are applied.

[1526]. 23.1 : 12.25 : 23.24. KANTOR, J. Studium rozdílu mezi přirozeně nalétými a uměle vysázenými sazenicemi. [**A study of the difference between natural regeneration and planted seedlings.**] *Lesn. Práce* 26 (4), 1947 (141–7). [Cz.e.]

In a large open group of natural regeneration chiefly of Norway Spruce, in an old mixed stand of Scots Pine, Norway Spruce and Larch, a randomly selected plot 3 × 6 m. in size was divided into 3 sections, each of 2 × 3 m. The first section was thinned in autumn to leave 20 Spruce seedlings, estimated to be 4 years old, and spaced practically uniformly about 50 × 80 cm. The second and third sections were cleared of all regeneration and planted with 4-year-old Spruce at the same spacing, the second section being planted in the same autumn and the third in the following spring. The best results (assessed over the first 3 growing seasons) as regards height growth (both average and total), survival, freedom from deer browsing, and invasion by other species desirable as an admixture to the Spruce, were given by the natural seedlings. Autumn planting gave intermediate, and spring planting the poorest results.

[1527]. 23.1 : 12.25. **Silvicultural studies: Southern Coast Forest.** *Rep. B.C. For. Serv. 1946*, 1947 (18–19).

The changes of site condition with lapse of time are being studied on typical Douglas Fir sites. A comparison of the regeneration following good to excellent seed crops in the first, third, and eighth years after logging indicates that the sites being studied are as receptive to reproduction 8 years after logging as at the beginning of regeneration. In fact the last crop of seed produced better results than those of previous years because vegetation develops slowly on these areas.

[1528]. 23.1 : 12.26–8 (548.7). HOLMES, C. H. **The natural regeneration of Ceylon forests.** *Trop. Agriculturist, Ceylon* 101 (2–4), 1945 (84–90; 136–47; 203–5). L.S.

An account is given of the results of research, and the current programme of research. It has been found that, though many species coppice freely from stools of large trees, much of the regeneration from so-called 'coppicing' is provided by shoots from cut-down seedlings and not by proper coppice shoots, which provided less than one-sixth of the total regeneration. For this reason, as well as from examination of dressed and untreated coppice stools, it is concluded that there is no special advantage to be gained from the dressing of stumps. In some species (e.g. *Gossampinus malabarica*, *Melia azadirachta*, and *Casuarina equisetifolia*), root suckering is so dependable that it may be employed to the total exclusion of seedlings; close young stands of these species may be raised by the simple expedient of soil wounding or surface trenching at intervals. Other species which propagate themselves freely by root suckers are *Diospyros melanoxylon*, *Pityranthe verrucosa*, *Cassia siamea* and *C. timorensis*, *Albizzia chinensis*, *C. fistula*, and *Stereospermum chelonoides*.

On the whole, the important timber species produce seed annually and disperse it effectually. Root competition from the trees of the parent overwood, rather than light, is probably the principal single factor adverse to natural regeneration. This competition is for soil

moisture rather than nutrients, and is more important in Dry-Zone forests. A controlled surface burn of the slash obtained from cutting the undergrowth assists the growth and vigour of young seedlings in this type of forest, but is unnecessary and undesirable in Wet Evergreen High forest, where it damages the typical thin-barked species of this type.

Soil conditions are less important than in artificial regeneration, but in the case of small-seeded species, such as *Adina cordifolia*, *Alstonia scholaris*, *Nauclea orientalis*, *Mitragyna parvifolia* and *tubulosa*, a fairly clean floor not closely covered with litter is necessary for successful germination. The normal shrub associates of natural regeneration are easily controlled, but profuse regeneration may disappear completely under the more prolific and fast growing weeds such as *Mikania scandens*, *Schizostigma hirsuta*, *Eupatorium conyzoides*, *Ochlandra stridula* and *Strobilanthes* spp. The incidence of certain weed species gives a rough indication of the extent of the opening-up of the overwood in natural regeneration operations. In the Wet Evergreen High Forest type, close growths of carpet grasses indicate very excessive opening-up; dense masses of *Trema orientalis* indicate a less excessive opening-up; *Macaranga peltata* shows that the gaps are just too big for general purposes, although *Dipterocarpus zeylanicus* can be successfully regenerated under it.

From a number of closely controlled experiments carried out in recent years, certain principles begin to emerge. The canopy condition under seeding fellings, most conducive to regeneration of Wet Evergreen High Forest, appears to be when gaps of about 1–1½ chains in diameter are evenly distributed and separated from one another by preferably not more than a single row of dominants. Under the procedure of raising the canopy gradually upwards, an ultimate canopy density of 0·5 appears to give the best results. Climber cutting is always a necessary preliminary to any form of treatment. Cleanings carried out annually in anticipation of monsoonal growing periods have generally given better and quicker results than more restricted cleanings carried out as and when considered desirable.

The subtropical Montane Forest type is the most difficult to regenerate naturally. The slow rate of growth of the mountain tree species, rather than special difficulties with weed species, is the controlling factor. In the Dry Mixed Evergreen High Forest type, which is often very inaccessible, plain deep girdling and poison frilling have been tried for the removal of overmature trees [cf. *For. Abstr.* 8 (No. 1066)]. The effects of plain deep girdling appear to take about 4 years to become apparent, compared with about 2 years for poison frill girdling. There are indications that the former method actually stimulates the understorey and shrubs to denser growth, thereby reducing the chances of regeneration establishing itself, whereas the more sudden opening up that follows poison frill girdling tends initially to check the understorey trees and undergrowth.

The results of the natural regeneration experiments are summarized in tabular form.

[1529]. 23.1 : 12.26–8 (498) : 11.32 : 34.21. HARALAMB, A. Păşunatul şi regenerarea pădurii la limită. [**Grazing and forest regeneration at the upper altitudinal limit of vegetation.**] *Rev. Pădurilor* 61 (11/12), 1947 (196–202). [Rum.f.]

Observations in the Carpathians show that old Beech woods can regenerate naturally at the upper altitudinal limit of vegetation, provided that grazing is excluded.

[1530]. 23.1 : 12.26–8 : 22.2. PAŞCOVSCHI, S. Inmulţirea prin drajonare la unele specii lemnoase în condiţiuni grele de vegetaţie. [**Regeneration of certain woody species by suckering in conditions adverse to vegetation.**] *Rev. Pădurilor* 54 (3/4), 1947 (105–8). [Rum.f.]

The author describes several cases of regeneration by suckering under heavy shade. The tendency is most frequent in *Euonymus europaeus* but has also been observed in *Tilia tomentosa*, *Sorbus* spp., *Prunus padus* and *Ligustrum vulgare*.

[1531]. 23.1 : 12.26–8 : 22.2. ZEHNGRAFF, P. J. **Response of young Aspen suckers to overhead shade.** *Tech. Notes Lake St. For. Exp. Sta.* No. 278, 1947. p. 1.

The present condition of a stand of 11-year-old Aspen [*Populus tremuloides*] sprouts, resulting from cutting, demonstrates the importance of competition upon the development of young Aspen. The original stand was cut, in 2-acre blocks, to different diameter limits (clear cut, 8, 9, and 10 in. d.b.h., no cutting), and the residual stand cut 6 years later. Stocking and

height growth were directly related to the degree of cutting. Suckers originating from the second cutting are being shaded out by those originating from the first. It is concluded that clear cutting is desirable in order to obtain regeneration. [Cf. *For. Abstr.* 9 (No. 1504).]

[1532]. 23.1 : 22.83 : 12.26–8 : 12.29. SAGREIYA, K. P. **[Natural regeneration of moist Teak/Bamboo forest.]** *Rep. For. Dep. C.P. and Berar 1945–46*, 1947 (14–15).

The difficulty of obtaining a well stocked two-storeyed forest with Teak in the upper storey and Bamboo in the lower, is largely due to the different rates of growth of the two species. Whereas Teak coppice starts with a very rapid rate of height growth which gradually declines and becomes very slow in 10 years, Bamboo regrowth after clear felling is at first slow, but increases year by year. If Bamboo is cut back repeatedly to favour Teak coppice, it may be killed. The system now being practised in the Central Provinces is as follows. The best Bamboo clumps are selected, spaced out roughly half a chain apart (about 50 to the acre), thinned by removing all old and dead culms, and marked conspicuously. All vigorous, well developed, financially immature Teak stems, well spaced out, are similarly selected and marked, and all unreserved growth is then felled and cleared away. In subsequent tending all Teak coppice under the reserved Bamboo clumps and all unreserved Bamboo regrowth are cut back. When the Teak eventually overtops the Bamboo, a two-storeyed forest with Teak in the canopy and Bamboo under it will be obtained.

23.2. *Artificial Regeneration*

[1533]. 23.2 (485). TIRÉN, L. Om skogsodling i Norrland. **[Artificial regeneration in Norrland.]** *Norrlands SkogsvFörb. Tidskr.* 1946 (2), (269–307). [Sw.] [Statens Skogsforskningsinstitut.]

A survey, in lecture form, of problems in the artificial regeneration of conifers in N. Sweden. For convenience, it is assumed that the choice between natural and artificial regeneration has been made, and that site preparation is not being done mechanically. (1) *Direct sowing*: (*a*) Whether for this purpose or for nursery use, seed samples should be sent for viability tests to the State Central Seed-testing Institution, and not tested on the spot. Viability is discussed on the same lines as in a previous paper [see *For. Abstr.* 8 (No. 215)]. (*b*) So far as possible, site preparation must rid the area of all trees and suppressed growth. The prevention of coppicing of Birch is a problem to which no satisfactory solution has yet been found, involving repeated cleanings where conifer regeneration is threatened. 'Ripening' of the site (decomposition of raw humus) proceeds at different rates according to local climate, position, etc. Though this process begins immediately after felling, regeneration is best postponed until it can be done at a reasonable cost and with a firm chance of success, as 'fresh' sites are more difficult to work on and as at higher altitudes mobilization of soil nutrients is very slow. Though the technique still needs improving, there is at present nothing to compare with burning, on raw-humus sites, for promoting humus decomposition, raising the nutrient status of the soil and facilitating work. Economically, burning is probably a sound proposition wherever it is known to have marked biological advantages. (*c*) Spring sowings beginning after the spring drought (mid-May to first week of July) have been more consistently successful than autumn ones. (*d*) Where mixtures of Scots Pine and Norway Spruce are used on intermediate sites, sowing separately is believed to be somewhat better than mixing the seed. (*e*) Sowing methods must be judged largely by their effectiveness against drought and frost-heaving, factors which make exposure of the mineral soil essential and a covering of relatively non-capillary material, e.g. gravel, desirable. Trials made with coverings of sawdust 1 cm. thick and with Spruce slash laid over the patches, were extremely successful, but neither method is applicable on a large scale. For maximum protection sowings should be made in narrow strips running E.—W., but almost as good results can often be obtained with ordinary patches, and if the ground vegetation is heavy the latter must be used. Sowings may be confined to opposite margins or to the S. and W. margins of patches. Suitable dimensions are 15–30 × 60–80 cm. for strips and 30 × 40–50 cm. for patches. A further method, very cheap and giving excellent results even on unburned areas, provided that the humus is not deep

and ground vegetation not abundant, is known as *rispsådd*. A pick-mattock is used to make a very narrow, rough-sided strip 60–80 cm. long: on light ground this can be done with the mattock blade alone; on heavier soils two lines are cut with the pick and the intervening strip lifted with the mattock end. Seed is then lightly worked in with a stick. Little is yet known about spacing of seed patches, but 1·7 m. apart (3,500 per ha.) is probably a safe average. With a germination per cent. of 70–80, about 30–40 fresh viable seeds should be sown per patch. (2) *Planting*: (*a*) The remarks under 'Sowing' on seed and site preparation apply to planting also. (*b*) Though the best season for planting is May–June, planting is again possible for 2–3 weeks after the middle of August. (*c*) Normal spacing is about 1·5 m. between plants and rows. (*d*) Nurseries may be central, but there is much to be said for decentralization, and temporary nurseries on felling sites have given good results. Fertilizing should be done, when necessary, with compost consisting chiefly of forest humus and some lime. N and P fertilizers should never be applied at the same time, or mycorrhiza formation may be inhibited. Animal manure should also be avoided on account of weed growth. Drills are made 4 cm. broad and 6–7 mm. deep and sown with 600–800 fresh viable seeds per running metre. Beds are covered with Spruce slash until seedlings emerge, after which the slash may be removed but should be retained near by for use when shade is necessary. All inferior plants should be rejected when lifting the stock for planting, the final yield being 100–150 good 2/0 plants per running metre. For long transport the plants should stand upright, in one layer only, on 10 cm. of wet sphagnum in trays having sides high enough to avoid the tops of plants protruding. For shorter trips several layers of plants may be laid horizontally, separated by layers of sphagnum. (*e*) As seedling stock is cheaper and most Norrland sites have only moderate ground vegetation, 2/0 plants of Scots Pine and 3/0 plants of Norway Spruce are generally to be recommended. (*f*) Notch planting is not recommended, at least pending further experience. Ordinary pit planting can be used for both Spruce and Pine. The latter, however, is best and most conveniently planted in crowbar holes. For Spruce, planting with roots flat underneath a turf (replaced in its normal position) is the best method on normal sites, though rather dear; on wet sites, planting in a crowbar hole in an inverted turf is to be preferred. (3) *Sowing* vs. *planting*: This question is briefly discussed on conventional lines. Planting is to be preferred where the humus is over 7–8 cm. deep, on wet land liable to bad frost-heaving, and where the ground flora is likely to be troublesome. [Cf. *For. Abstr.* 8 (No. 208).]

[1534]. 23.2 (676). **Intensive silviculture — fuel, and pole plantations.** *Rep. For. Dep. Uganda 1946*, 1947 (10–11).

Plantations must be hoed before planting and kept completely clean by frequent hoeing until fully established. Spot hoeing and slashing are useless. Blanks must be filled in the first year as soon as deaths occur, and in the April rains of the second year. If a plantation is not fully established by the end of the second year, no further replacement work must be undertaken till it is felled and replanted. If the above intensive methods are employed, a plantation (of e.g. *Eucalyptus*) on a good site in Uganda should be fully established and require no further tending by 18 months after planting, at the latest. Costs are much less than those of less intensive methods which drag on for years and result in a poor crop and low yield.

[1535]. 23.2 (729.5) : 02.1 : 12.19.1. GILORMINI, J. A. Manual para la propagación de árboles y el establecimiento de plantaciones forestales en Puerto Rico. [**Manual for the rearing of trees and the establishment of forest plantations in Puerto Rico.**] Servicio Forestal, Departamento de Agricultura y Comercio, Gobierno de Puerto Rico. [1947?] pp. 125. [Span.]

A practical handbook with a list of the exotic and native trees and shrubs of Puerto Rico and their equivalent English names.

23.22. Preparatory Work. Auxiliary Measures

See also *For. Abstr.* 9 (Nos. 1486, 1550).

[1536]. 23.22.1 : 07.7. GEERLING, L. C. Een paar eenvoudige boschwerktuigen. [**A few simple forestry implements.**] *Ned. Boschb.-Tijdschr.* 19 (5), 1947 (139–42). [Du.]

Briefly describes: (1) the use of the track of a Bren-gun carrier as a simple form of chain-harrow for exposing the mineral soil on sites with little ground cover; (2) a locally made ridge-plough for sites with heavier cover; (3) a locally made modification of a Danish sub-soiling implement (that of F. Muus and T. S. Wielandt), having four rotating arms mounted in a cross and sprung so as to kick free on meeting an obstacle in the ground. The plough and the subsoiler are illustrated.

[1537]. 23.22.1 : 11.47 : 11.42. GRIFFITH, A. L. **The effects of burning on the soil as a preliminary to artificial regeneration.** *Indian For. Bull.* (*n.s.*) *Silviculture* No. 130, (1943) 1946. pp. 34 + plates.

The bulletin is divided into three parts. Part I contains a general summary of the theoretical considerations involved and the extent of our present knowledge of the problem together with references to published literature; Part II describes the Dehra Dun investigations; Part III gives the experimental data in detail. The experiments, which were carried out on an exhausted agricultural loamy soil, resulted in the following conclusions:—

(1) Removal of ash from a burnt area causes a significant decrease in the soil moisture equivalent. (2) Burning, and more especially the ash, causes a significant increase in the pH value in the top soil and in nitrogen as nitrates. (3) The heat of the burn penetrated so slightly into the soil that even in the top 3 in. it was not intense enough either to destroy the intimate humus or to break the clay complex. (4) Burning, with or without the removal of ash, causes a significant increase in height growth, but the intensity of the effect varies with the different species. (5) The addition of ash to an unburnt soil causes a significant increase in height growth, but this increase is much less intense than that caused by a burn with or without the removal of the ash. (6) The beneficial effect on the height growth is especially pronounced in the first year, but even after two years, differences are still significant. The bulletin concludes with suggestions for improvements in future experimental work. *From author's summary.*

[1538]. 23.22.1 : 12.26–8 (560) : 33. KARADUMAN, R. Orman içi Ağaçlandermalari ve Orman Gülü. [**Regeneration and wild Rhododendron.**] *Orman ve Av* 17 (3), 1945 (79–81). [Turk.]

The Black Sea coastal region is one of the 8 natural forest regions in Turkey. In its eastern and central parts the underwood consists mainly of *Rhododendron ponticum*, *R. flavum*, *Prunus laurocerasus*, *Ilex* and *Vaccinium* spp. The *Rhododendron* thickets are removed by felling and digging out the roots as completely as possible. The prepared cleared area is restocked by dibbling in seeds; transplants are too expensive. Rhododendron wood makes a good fuel for ovens and kilns, and also yields a good charcoal with a white ash. The larger stems are used for posts and fences. [Cf. *For. Abstr.* 9 (No. 1882).]

[1539]. 23.22.2 (675) : 97.1 : 11.62.11. RENARD, P. J. J. Quelques considérations sur la régénération des sols de savane. [**The regeneration of savanna soils.**] *Bull. agric. Congo belge* 38 (3), 1947 (627–34). [F.flem.]

The author describes methods of regenerating savanna soils subjected to shifting cultivation, which he developed in the Velé region of the Belgian Congo.

On savanna with trees, the agricultural practice is to cut down all trees, grow cotton for one year, a cereal crop the second year, and then let the land revert to fallow. Coppice growth is repeatedly cut back, and tree seedlings are pulled up. In the 1945–46 cotton season, as an experiment, forest seedlings and coppice shoots were left untouched in certain cotton fields. Their numbers were estimated at about 10,000 to the ha., but they appeared to have no harmful effect on the yield of cotton, which averaged 450 kg./ha. In order to encourage coppice regrowth, trees should be felled at a height of 40 cm. from the ground. Weeding is usually carried on up to the moment of harvesting the cotton, but it is easy to train the native to leave tree seedlings, and to spare coppice shoots after the end of September, by which time the cotton has finished making its growth and can no longer be harmed by shade. It may be necessary in some cases to prune the coppice re-growth in the following summer in order to give light and air to the cereal crops. After 10 months the coppice shoots in this experiment had attained an average height of 1·62 m. When the cereal crop which ends the rotation is harvested, the young forest has already had 12 months' growth.

On treeless savanna soils, it is suggested that the native cultivator should be encouraged to plant tree seeds at the same time as groundnuts.

23.23. Seed and Sowings

See also *For. Abstr.* 9 (No. 1499).

23.23.1. *Seed Procurement, Treatment, and Testing*

See also *For. Abstr.* 9 (Nos. 1456, 1545, 1547, 1553, 1555).

[1540]. 23.23.1 : 12.25 : 23.1. DOWNS, A. A. **Choosing Pine seed trees.** *J. For.* 45 (8), 1947 (593–4). [Stheast. For. Exp. Sta.]

In the abundant 1946 seed crop of *Pinus taeda* in Eastern Virginia it was found that there was an almost straight linear relationship between number of cones per tree and d.b.h. up to 18 in. There is some evidence that seed-producing capacity is an inheritable characteristic, and it is suggested it would be wise to select for seed, trees of known seed-producing capacity, i.e. those with old cones on them.

[1541]. 23.23.12 (794) : 12.11.3. FOWELLS, H. A. **Forest tree seed collection zones in California.** *For. Res. Notes Calif. For. Range Exp. Sta.* No. 51, 1946. pp. 4 + map.

The forests of California are divided in this paper into forest tree seed collection zones. The great range of types and sites in the forests of California demands that the general principles of seed provenance should be observed, and the establishment of zones also simplifies the keeping of records of seed lots.

[1542]. 23.23.15 : 12.25. MACMORRAN, A. M. **Experimental seed storage.** *J. N.Z. Inst. Hort.* 15 (3), 1946 (25–34). L.S.

A study of seed-storage methods, using seed of 3 indigenous and 6 exotic coniferous species, has been in progress since 1941 at the head office of the State Forest Service, Wellington, N.Z. Reduction of initial moisture content by 2–3 per cent. had no significant effect on germinative capacity. Storage tests at room temperatures and various refrigeration temperatures are in progress. The seeds are to be stored for 10 years with annual or biennial tests. Preliminary results indicate that while the indigenous species lose a certain amount of viability even after short periods, cold storage is better than room temperature for these species. Seeds of exotic species, *Pinus* spp., *Pseudotsuga taxifolia* and *Cryptomeria japonica* can tolerate storage at normal temperatures for several years without complete loss of viability, but the lower the temperature the better.

[1543]. 23.23.15 : 12.26–8. LUPE, I. O experiență de păstrarea semințelor de Caragană în miniu și acid cianhidric. [**An experiment in the preservation of *Caragana* seed in red lead and hydrocyanic acid.**] *Rev. Pădurilor* 61 (9/10), 1946 (113–9). [Rum.f.]

Seed of *Caragana arborescens* was treated in 1942, and germination tests were made in 1944, 1945 and 1946. Five treatments were used: (1) untreated seeds stored in open tubes; (2) untreated seeds stored in sealed tubes; (3) seeds dusted with red lead and stored in sealed tubes; (4) seeds coated with moist red lead, then dried in the sun, and stored in sealed tubes; (5) untreated seeds stored in a sealed tube with a piece of cyanide of potassium. Results are tabulated and the following conclusions drawn from the experiment:—Powdered red lead does no harm to and seems even to increase the germinative capacity of *Caragana* seed, but red lead applied damp and then dried diminishes it. Germinative capacity is preserved better in sealed than in open vessels. The use of hydrocyanic acid as an insecticide is recommended only for short periods. After a year it kills the seed. *From author's summary.*

[1544]. 23.23.15 : 12.26–8. BARTON, L. V. **Special studies on seed coat impermeability.** *Contr. Boyce Thompson Inst.* 14 (7), 1947 (355–62).

Experiments to render permeable the hard coats of some leguminous seeds revealed certain distinguishing characters of subfamilies. Seeds of members of the Papilionoideae were made permeable by shaking in a glass bottle for 20 minutes, but soaking in pure alcohol was without effect. Seeds of the Caesalpinioideae, on the other hand, were made permeable by soaking in pure alcohol for 72 hours but, with one exception (*Parkinsonia microphylla*), were not affected by shaking. Seeds of Mimosoideae seemed to occupy an intermediate position, some responding to shaking and some to alcohol soaking. Impermeable seeds of *Melilotus alba* (Papilionoideae) could be made to absorb water by plunging them in liquid nitrogen, a treatment which had no effect on

impermeable seeds of *Gleditsia triacanthos* (Caesalpinioideae). It is suggested that there may be at least two different types of impermeability in the coats of seeds of Leguminosae, and that these types may be indicated by their response to either shaking or alcohol treatment.

23.23.3. *Methods of Sowing*

See also *For. Abstr.* 9 (No. 1567).

[1545]. 23.23.3 : 12.25 : 23.23.15. CURTIS, J. D., and STEINBAUER, G. P. **Effects of variations in moisture and depth of planting on germination of seeds of Northern White Cedar.** *J. For.* 45 (8), 1947 (592–3).

A previous study of *Thuja occidentalis* showed that on certain sites little or no reproduction of this species occurs though the seed is known to have a high degree of viability. The present study of the response of seed of this species to variations in moisture content of the substrate and to depth of planting was made in the hope of explaining this failure. The results of the tests show that: (1) The seed of *Thuja occidentalis* germinates under a wide range of moisture conditions though maximum germinations were reached sooner in the media held at 40–80 per cent. of water-retaining capacity. (2) Germination tended to vary inversely with depth of sowing, from 63 per cent. on the surface to 24 per cent. at ½ in. (3) Seed stored for 8 months in different conditions of relative humidity ranging from 4·5 to 89 per cent. did not germinate at relative humidities above 25 per cent.

[1546]. 23.23.3 : 12.25. MINCKLER, L. S., and DOWNS, A. A. **Machine and hand direct seeding of Pine and Cedar in the Piedmont.** *Tech. Note Stheast. For. Exp. Sta.* No. 67, 1946. pp. 10.

A guide to direct sowing of *Pinus echinata*, *P. taeda*, and *Juniperus virginiana* in the Piedmont region of Virginia and Carolina. It briefly reviews the results of experimental and pilot-plant trials of both hand and mechanical methods of direct sowing and describes in detail the recommended methods.

[1547]. 23.23.3 : 12.26–8 : 23.23.15. HEIT, C. E. **Fall planting of hardwood tree seed.** *Farm Res. N.Y.* 11 (3), 1945 (14–15).

Gives dates of sowing and pre-treatment, if any, necessary to obtain satisfactory germination of the commoner northern American hardwoods. Husks should be removed from *Carya* and *Juglans* spp. Fruit of *Prunus serotina* and *Sorbus* spp. should be macerated. Mulching is necessary for *Carya* spp., *Liriodendron*, *P. serotina*, *Quercus alba* and *Tilia americana*, in order to prevent freezing of the soil.

23.24. Formation of Stands by Planting

See also *For. Abstr.* 9 (Nos. 1433, 1526).

[1548]. 23.24 : 12.26–8 (81) : 21.0 : 33.5 : 33.7. Hortos florestais ferroviários. **[Railway forest plantations.]** *Brasil madeireiro* 3 (24), 1947 (5–7). [Port.]

Practices to be followed in establishing *Eucalyptus* plantations in Brazil are briefly set out with an estimate of costs. The plantations are destined to provide the railways with wood for fuel, sleepers and posts. Species most suitable for fuel are *E. saligna* and *E. alba*, while *E. citriodora* and *E. alba* are recommended for sleepers and posts. [Cf. *For. Abstr.* 8 (No. 1707).]

23.24.2. *Methods of Planting*

See also *For. Abstr.* 9 (No. 1455).

[1549]. 23.24.2 (676). **Planting methods in Budongo Forest.** *Rep. For. Dep. Uganda 1946*, 1947 (8–9).

Khaya anthotheca was planted pure in alternate lines, the intervening lines being filled with other species of value, chiefly *Entandrophragma utile* and *E. angolense*, *Chlorophora excelsa* and *Mildbraediodendron excelsum*. Most trees flushed within 4 weeks of planting as a result of a new practice of retaining the side and fibrous roots of transplants instead of pruning them. This makes ramming of the soil more difficult, but by widening the mouth of the planting pit and exercising some care in beating down the soil round the roots, firm planting without air pockets can be obtained. The result is more assured and speedier establishment. It is important that transplants should be planted within 24 hours of lifting.

moisture rather than nutrients, and is more important in Dry-Zone forests. A controlled surface burn of the slash obtained from cutting the undergrowth assists the growth and vigour of young seedlings in this type of forest, but is unnecessary and undesirable in Wet Evergreen High forest, where it damages the typical thin-barked species of this type.

Soil conditions are less important than in artificial regeneration, but in the case of small-seeded species, such as *Adina cordifolia*, *Alstonia scholaris*, *Nauclea orientalis*, *Mitragyna parvifolia* and *tubulosa*, a fairly clean floor not closely covered with litter is necessary for successful germination. The normal shrub associates of natural regeneration are easily controlled, but profuse regeneration may disappear completely under the more prolific and fast growing weeds such as *Mikania scandens*, *Schizostigma hirsuta*, *Eupatorium conyzoides*, *Ochlandra stridula* and *Strobilanthes* spp. The incidence of certain weed species gives a rough indication of the extent of the opening-up of the overwood in natural regeneration operations. In the Wet Evergreen High Forest type, close growths of carpet grasses indicate very excessive opening-up; dense masses of *Trema orientalis* indicate a less excessive opening-up; *Macaranga peltata* shows that the gaps are just too big for general purposes, although *Dipterocarpus zeylanicus* can be successfully regenerated under it.

From a number of closely controlled experiments carried out in recent years, certain principles begin to emerge. The canopy condition under seeding fellings, most conducive to regeneration of Wet Evergreen High Forest, appears to be when gaps of about 1–1½ chains in diameter are evenly distributed and separated from one another by preferably not more than a single row of dominants. Under the procedure of raising the canopy gradually upwards, an ultimate canopy density of 0·5 appears to give the best results. Climber cutting is always a necessary preliminary to any form of treatment. Cleanings carried out annually in anticipation of monsoonal growing periods have generally given better and quicker results than more restricted cleanings carried out as and when considered desirable.

The subtropical Montane Forest type is the most difficult to regenerate naturally. The slow rate of growth of the mountain tree species, rather than special difficulties with weed species, is the controlling factor. In the Dry Mixed Evergreen High Forest type, which is often very inaccessible, plain deep girdling and poison frilling have been tried for the removal of overmature trees [cf. *For. Abstr.* 8 (No. 1066)]. The effects of plain deep girdling appear to take about 4 years to become apparent, compared with about 2 years for poison frill girdling. There are indications that the former method actually stimulates the understorey and shrubs to denser growth, thereby reducing the chances of regeneration establishing itself, whereas the more sudden opening up that follows poison frill girdling tends initially to check the understorey trees and undergrowth.

The results of the natural regeneration experiments are summarized in tabular form.

[1529]. 23.1 : 12.26–8 (498) : 11.32 : 34.21. HARALAMB, A. Păşunatul şi regenerarea pădurii la limită. [**Grazing and forest regeneration at the upper altitudinal limit of vegetation.**] *Rev. Pădurilor* 61 (11/12), 1947 (196–202). [Rum.f.]

Observations in the Carpathians show that old Beech woods can regenerate naturally at the upper altitudinal limit of vegetation, provided that grazing is excluded.

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The author describes several cases of regeneration by suckering under heavy shade. The tendency is most frequent in *Euonymus europaeus* but has also been observed in *Tilia tomentosa*, *Sorbus* spp., *Prunus padus* and *Ligustrum vulgare*.

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height growth were directly related to the degree of cutting. Suckers originating from the second cutting are being shaded out by those originating from the first. It is concluded that clear cutting is desirable in order to obtain regeneration. [Cf. *For. Abstr.* 9 (No. 1504).]

[1532]. 23.1 : 22.83 : 12.26–8 : 12.29. SAGREIYA, K. P. **[Natural regeneration of moist Teak/Bamboo forest.]** *Rep. For. Dep. C.P. and Berar 1945–46*, 1947 (14–15).

The difficulty of obtaining a well stocked two-storeyed forest with Teak in the upper storey and Bamboo in the lower, is largely due to the different rates of growth of the two species. Whereas Teak coppice starts with a very rapid rate of height growth which gradually declines and becomes very slow in 10 years, Bamboo regrowth after clear felling is at first slow, but increases year by year. If Bamboo is cut back repeatedly to favour Teak coppice, it may be killed. The system now being practised in the Central Provinces is as follows. The best Bamboo clumps are selected, spaced out roughly half a chain apart (about 50 to the acre), thinned by removing all old and dead culms, and marked conspicuously. All vigorous, well developed, financially immature Teak stems, well spaced out, are similarly selected and marked, and all unreserved growth is then felled and cleared away. In subsequent tending all Teak coppice under the reserved Bamboo clumps and all unreserved Bamboo regrowth are cut back. When the Teak eventually overtops the Bamboo, a two-storeyed forest with Teak in the canopy and Bamboo under it will be obtained.

23.2. *Artificial Regeneration*

[1533]. 23.2 (485). TIRÉN, L. Om skogsodling i Norrland. **[Artificial regeneration in Norrland.]** *Norrlands SkogsvFörb. Tidskr.* 1946 (2), (269–307). [Sw.] [Statens Skogsforskningsinstitut.]

A survey, in lecture form, of problems in the artificial regeneration of conifers in N. Sweden. For convenience, it is assumed that the choice between natural and artificial regeneration has been made, and that site preparation is not being done mechanically. (1) *Direct sowing*: (*a*) Whether for this purpose or for nursery use, seed samples should be sent for viability tests to the State Central Seed-testing Institution, and not tested on the spot. Viability is discussed on the same lines as in a previous paper [see *For. Abstr.* 8 (No. 215)]. (*b*) So far as possible, site preparation must rid the area of all trees and suppressed growth. The prevention of coppicing of Birch is a problem to which no satisfactory solution has yet been found, involving repeated cleanings where conifer regeneration is threatened. 'Ripening' of the site (decomposition of raw humus) proceeds at different rates according to local climate, position, etc. Though this process begins immediately after felling, regeneration is best postponed until it can be done at a reasonable cost and with a firm chance of success, as 'fresh' sites are more difficult to work on and as at higher altitudes mobilization of soil nutrients is very slow. Though the technique still needs improving, there is at present nothing to compare with burning, on raw-humus sites, for promoting humus decomposition, raising the nutrient status of the soil and facilitating work. Economically, burning is probably a sound proposition wherever it is known to have marked biological advantages. (*c*) Spring sowings beginning after the spring drought (mid-May to first week of July) have been more consistently successful than autumn ones. (*d*) Where mixtures of Scots Pine and Norway Spruce are used on intermediate sites, sowing separately is believed to be somewhat better than mixing the seed. (*e*) Sowing methods must be judged largely by their effectiveness against drought and frost-heaving, factors which make exposure of the mineral soil essential and a covering of relatively non-capillary material, e.g. gravel, desirable. Trials made with coverings of sawdust 1 cm. thick and with Spruce slash laid over the patches, were extremely successful, but neither method is applicable on a large scale. For maximum protection sowings should be made in narrow strips running E.—W., but almost as good results can often be obtained with ordinary patches, and if the ground vegetation is heavy the latter must be used. Sowings may be confined to opposite margins or to the S. and W. margins of patches. Suitable dimensions are 15–30 × 60–80 cm. for strips and 30 × 40–50 cm. for patches. A further method, very cheap and giving excellent results even on unburned areas, provided that the humus is not deep

[1550]. 23.24.2 : 11.49.5 (775) : 23.22.1 : 23.21. STOECKELER, J. H. **Planting poorly-drained wet sites.** *Tech. Notes Lake St. For. Exp. Sta.* No. 276, 1947. p. 1.

Experiments were made in Wisconsin on a poorly drained silt loam with a clay subsoil, with 3 methods of ground preparation and 5 species. The area was furrowed at intervals of 12 ft. with a Killefer plough, and planting was done (1) on top of the back-turned furrow, (2) in the bottom of the furrow, (3) on scalped spots between the furrows. The results showed considerably better survival and growth with (1) than with (2) or (3). The best species for such sites appeared to be Black Spruce [*Picea mariana*] and White Spruce [*P. glauca*], with White Ash [*Fraxinus americana*] as a possible third.

[1551]. 23.24.2 : 07.7. **New tree planter.** *Sth. Lumberm.* 175 (2195), 1947 (64).

The Lowther tree planter manufactured by the Lowther Co., of Chicago, has established a planting rate of 10,000 trees per day. Specially designed for use on cut-over land where the ground is filled with heavy roots and old stumps, it can be drawn by any type of farm tractor. It will work satisfactorily on all types of soil and on slopes of up to 30 per cent.

23.24.3. *Spacing*

[1552]. 23.24.3. ANDERSON, M. L. **A method of forest planting by groups.** *J. Oxf. Univ. For. Soc.* (*3rd Ser.*) No. 2, 1947 (63–6).

The author describes a method of spacing trees in afforestation operations, first put forward by himself 20 years ago, and illustrates it by examples in Scotland and Ireland. The basic idea underlying the system was to economize planting material, not by increasing the planting distance from 3 to 6 ft. or more, but by increasing the *average* planting distance by an equivalent amount, and to achieve this by planting the trees in dense groups separated by unplanted areas. The method gives most promise as a method of growing tender broad-leaved species with hardy coniferous nurses in which the normal stem-by-stem mixture usually results in the main species being crowded out. It is also advantageous on poor ground requiring intensive preparatory treatment, since this can be confined to the group areas, and the close planting of the groups ensures rapid closing of the canopy, with resultant vegetation suppression and soil improvement. A ground fire passing through an area recently planted in this way did not damage the trees on the prepared patches.

23.26. Plant Rearing. Nursery Practice

See also *For. Abstr.* 9 (No. 1499).

[1553]. 23.26 : 12.26–8 : 23.23. CHASE, S. B. **Eastern Black Walnut germination and seedbed studies.** *J. For.* 45 (9), 1947 (661–8).

Germination of *Juglans nigra* and growth of seedlings for rootstock purposes were investigated with particular reference to effect of planting time, methods and time of stratification, depth of planting, orientation of seed, weight of kernel, and nut spacing in seedbeds.

[1554]. 23.26 : 23.24.1. HALLANDER, Å. En tilltalande plantpackningsmetod. [**A promising method of plant packing.**] *Skogen* 34 (13/14), 1947 (202–3). [Sw.]

Quotes a brief description by Jørgensen [see *For. Abstr.* 8 (No. 2243)] of the plant packing device used at the Green Timber and Wind River nurseries, and reports a preliminary trial made at Lyckås nursery, Jönköping, in 1947. Here leather straps were used instead of the steel wires of the bundling device in the American model. The total cost of the apparatus was Kr. 25. The wrapping used was 'Oceanpapper' (125 g./sq.m.) in strips 75 cm. wide, though rather broader strips would have been better for the larger plants. Three laths were used as splints for each bundle of 500 2/2 Norway Spruce, packed head to tail with a filling of moist peatmould. The bundles, weighing about 30 kg. each, were easy to handle and to pack on a lorry, the lath splints forming convenient handles. The paper held satisfactorily for the 2–3 days required for transit.

Though no details are given of costs, the method is recommended for further trial.

[1555]. 23.26 : 44.3 : 12.25–8 : 12.21 : 23.23.15. ZHURAVLEV, I. I. Prakticheskie ukazaniya po dezinfektsii lesnykh semyan i pochvy. [**Practical notes on the disinfecting of forest seeds and soil.**] Tsentral'ny Nauchno-Issledovatel'ski Institut Lesnogo

Khozyaystva (TsNIILKh), Ministerstvo Lesnoy Promyshlennosti SSSR, Leningrad. 1947. pp. 26. [Russ.]

A practical guide to the control of damping-off, with particular reference to that caused by species of *Fusarium*.

Chapter I contains a description of symptoms and brief notes on taking samples of seed and soil for mycological examination. Chapter II, devoted to fungicidal treatments, has main sections on:—(1) *Methods in general*. (2) *Seed treatments*:—(i) Steeping, with a table indicating suitable fungicides ($KMnO_4$ solution is regarded as the safest and easiest to use), concentrations and periods of treatment for seed of the commonest Russian species, together with notes on apparatus. (ii) Spraying, which is seldom used and not recommended. (iii) Dry powder treatments, which are promising but as yet little used (for lack of sufficient experience) in Russian forest nurseries. (3) *Soil sterilization*:—(i) With solutions of formalin, mineral acids or $KMnO_4$. (ii) Fumigation with formalin. (iii) Heating by means of boiling water or burning brushwood. (iv) Fungicides applied after sowing and either before or after germination.

The author's own experiments have shown that 1-per-cent. $KMnO_4$ can be applied with benefit after sowing, at rates of 6–12 litres (according to soil moisture) per sq.m. of seed-bed. Data on the use of other fungicides at this stage are regarded as conflicting or inadequate as yet. If *Fusarium* has already appeared in a bed, control may be effected in the early stages of attack by treatment, if necessary more than once, with $KMnO_4$ solution, using 30–100 g. $KMnO_4$ in 6–10 l. water per sq. m. Alternatively, 1-per-cent. acetic acid or 0·15-per-cent. formalin may be used, but in this case ordinary watering must be done after about half an hour to prevent injury to the seedlings. (4) *Precautions* to be observed when handling poisons.

Chapter III includes notes on disinfecting the equipment used in seed storage, and a bibliography of 11 references, all Russian.

23.3. *Afforestation*

See also *For. Abstr.* 9 (Nos. 1486, 1510, 1992).

[1556]. 23.3 (410) : 12.19.3 : 11.44. FENTON, E. W. **Indications of former woodland as an aid for afforestation.** *Scot. For.* 1 (1/2), 1947 (23–7).

The writer urges the necessity of making a biological survey of Scotland as a guide to proper land use, and points out the particular value of relict ground flora as an indication of former woodland and therefore of land suitable for afforestation. For instance, fragmentary traces of the *Phegopteris dryopteris/Primula vulgaris/Sanicula europaea/Mercurialis perennis* type, which is characteristic of mixed deciduous woodland, may sometimes be found on rough hill grazings far from any woods. Species typical of Pine woods are *Pyrola minor*, *Trientalis europaea*, and *Goodyera repens*.

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[1558]. 23.3 (481) : 11.49.5 : 97.3. BU, A. Sau, beite, skogbruk og myrdyrking. [**Sheep, grazing, forestry and the reclamation of wet peatland.**] *Tidsskr. Skogbr.* 53 (9/10), 1945 (197–202). [Nor.] *Repr.* from *Medd. norske Myrselsk.*

Discusses the advantages of using the waste peatland, particularly of West Norway, partly for summer sheep-grazing with winter burning of the heather, as in Scotland, and partly for afforestation after enclosure.

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Describes 7 plantations on different soils and old workings in Central Jutland. Broadleaved and coniferous trees (in one plantation including fruit trees) were planted, the ground in some cases being first levelled. Results after periods varying from 10 to 25 years indicate that Lodgepole and Mountain Pines, either alone or mixed with Scotch Pine, are suitable for sandy soils; Sitka, Red and White Spruces or, where the water level is not too far down, Birch, Alder and Willow, for clay and loamy soils. Japanese Larch can be used where there is

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enough shelter. It is too early to say what financial value these plantations may have, but fair growth can be expected where species suited to the soil are chosen, and they are valuable for amenity reasons, to provide cover for wild life and to stop sand-drift.

[1560]. 23.3 (498) : 11.62.11. VERONE, P. Asupra nisipurilor sburătoare dela granița de nordvest a Țării. **[The moving sands of the north-west frontier of Transylvania.]** *Rev. Pădurilor* 62 (1/3), 1947 (34–7). [Rum.]

A short account of the origin and character of the moving sands of north-west Transylvania and the plantations of *Robinia pseudoacacia* which have been made for the purpose of fixing them. Attempts are now being made to introduce Oak into the *Robinia* stands. Other species which have been tried are *Pinus sylvestris*, *P. nigra* var. *austriaca*, *Gleditsia* sp., *Juglans* spp., *Rhus* sp., *Elaeagnus* sp., *Amorpha fruticosa*, *Morus* sp., *Populus* spp.

[1561]. 23.3 (61 :56) : 12.26–8. HARDY, E. **Conquering the deserts of the Middle East.** *Crown Colonist* 7 (184), 1947 (141). O.G.

Recent botanical exploration in desert areas of the Middle East has suggested the possibility of their development for the production of wood for fuel and charcoal. The Middle East Biological Scheme's expedition to the Wadi Arabah desert in 1946 discovered considerable areas of sand-dune desert dominated by the large, woody, desert shrub *Haloxylon persicum*, which is also dominant over thousands of square miles of the Syrian and Northern Arabian deserts. *Pistacia atlantica*, hitherto unknown in Asia, has been found growing in thousands in the mountains and deserts of northern Syria. There is evidence that this tree was formerly much more abundant in the desert, and its discovery in a region not suitable for the irrigated cultivation of other plants raises the question of its economic possibilities. Remnants of a forest of Juniper, Cypress and *Pistacia atlantica* have also been found in the mountains of Trans-Jordan, north of Petra.

[1562]. 23.3 (65) : 11.62.11. PUTOD, R. Le plan de reboisement et de restauration. **[The plan for reforestation and reclamation.]** *Bull. Soc. Agric. Algérie* 88 (513), 1945 (172–81). [F.] L.S.

An account of the programme of afforestation carried out in Algeria since 1850. The programme envisaged in 1885 made provision for the afforestation of 110,000 ha.; the amount actually covered by forest is a little more than 10,000 ha.

[1563]. 23.3 (81) : 11.62.11. AGUIAR, J. F. Fixacão de dunas. **[Stabilization of sand dunes.]** *Rev. flor., Rio de J.* 5 (2), 1946 (38–40). [Port.]

A brief account of the work in progress and plans for the fixation of the sand dunes at Marambaia on the Brazilian coast. The small Palm 'Gurizi' (*Diplothemium maritimum*), *Ipomoea pes-caprae* and various Gramineae form the natural vegetation of the dunes and will be used in the first stages of stabilization. The Gramineae and *Ipomoea*, having first been established nearest to the sea, are to be followed by plantations of suitable kinds of Myrtaceae. Farther back and by degrees, 4 or more rows of suitable species of *Casuarina* will be planted, at right angles to the prevailing wind. Protective barriers of fallen tree trunks, palisades, etc. will be erected along the foreshore.

23.4. *Formation of Forest by Natural Succession*

See also *For. Abstr.* 9 (No. 1487).

[1564]. 23.4 (481) : 11.62.11 : 12.26–8. WISTH, O. M. Noen forstlige betraktninger omkring Verdalsskredet. **[Forestry considerations relating to the Verdal landslide.]** *Tidsskr. Skogbr.* 53 (3/4), 1947 (58–62). [Nor.]

Describes the gradual spread of Alder thickets with consequent enrichment of the nitrogen-lacking clay and increase of other vegetation on a tract of land buried by a landslide in 1893. It discusses the potential commercial value of the Alder and the future treatment of the area.

[1565]. 23.4 (744) : 22.88.2 : 12.25 : 12.26–8 : 11.48 : 22.6 : 23.1 : 24. LUTZ, R. J., and CLINE, A. C. **Results of the first thirty years of experimentation in silviculture in the Harvard Forest, 1908–1938. Part I. The conversion of stands of old field origin by various methods of cutting and subsequent cultural treatments.** *Bull. Harv. For.* No. 23, 1947. pp. 182.

The conversion of stands of old-field origin is illustrated by 14 cases chosen as representative of the various reproduction methods tried out by the Harvard Forest staff, of the results obtained under the differing site

conditions, and of the varying cultural treatments applied to the new stands. In the case of old-field stands on heavy soils the results were practically the same regardless of the reproduction methods employed. A strong tendency of hardwoods to follow old-field Pine [*Pinus strobus*] was not successfully counteracted by any of the reproduction methods employed nor by subsequent weeding to favour the Pine. On medium soils the proportion of White Pine or other softwoods in the new stands is decidedly greater, and these may fairly be called mixed White Pine and hardwood stands. On light soils the proportion of White Pine is still greater. The conclusion is inescapable that soil is the predominant factor in determining the outcome of reproduction methods, and that attempts to encourage species not in the natural line of succession for a given site prove unsuccessful and costly beyond all hope of return commensurate with the outlay.

The results of the various cultural treatments applied in young stands cannot yet be fully appraised, but competition between hardwoods and softwoods has been reduced by segregating them into groups, Pine weevil attack has been lessened by using hardwoods as a protective cover, and the gypsy moth has been checked by reducing the proportion of favoured food species. *From authors' summary.*

[1566]. 23.4 (748) : 12.26–8. BURNHAM, C. F., FERREE, M. J., and CUNNINGHAM, F. E. **The Scrub Oak forests of the Anthracite Region.** *Sta. Pap. Ntheast. For. Exp. Sta.* No. 4, 1947. pp. 8.

A study of the Scrub Oak [*Quercus ilicifolia*] stands in the Anthracite Region of Pennsylvania was made in 1945. The evidence obtained indicates that Scrub Oak areas will revert naturally to other tree species when fires are kept out. The species that most often replace Scrub Oak are Sassafras, Red Maple, Chestnut Oak and Red Oak. It would, however, take at least 40 years for the invading species to occupy the area, and another 40 before it produced a merchantable stand; research is needed to discover methods of speeding up the process.

23.5. *Filling Gaps (Beating Up). Shelterwoods. Nurses*

[1567]. 23.53 : 23.23.3 (544). BHARGAVA, O. P. **Method of patch plantation in felled coupes and blanks.** *Gwalior For. Bull.* No. 1, 1946. pp. 5.

Describes a method of patch-sowing to fill in blanks or supplement coppice re-growth in cut-over areas in Gwalior. The species recommended are *Acacia arabica, A. catechu, Anogeissus pendula, A. latifolia, Bombax malabaricum, Melia azadirachta, Dalbergia sissoo, Prosopis juliflora.* The method is as follows:—(1) slash and brushwood are piled on the patch to be sown, well pressed down, and burnt. (2) The ash is carefully mixed with the topsoil, to a depth of about 6 in. and the whole area protected from rain-wash by a bank of earth or small pebbles, 6–9 in. high. (3) Seed is sown in lines 3–4 ft. apart at a depth of ½ in. (4) The patch should be fenced with a thorn hedge. (5) Careful weeding, hoeing, repair of bunds and thinning are most important.

23.6. *Care and Inspection of Regeneration in the Initial Stage of Establishment*

[1568]. 23.6. LONG, H. D. **Problems of regeneration surveys.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 919 (F–2), 1947. pp. 3.

The author discusses the time when regeneration surveys should be made, the methods to be employed, the data that should be gathered, and how these should be analysed. It is concluded that one survey should be made before cutting and one 5 years later, with possibly a third after another 5 years. The stocked quadrat method is probably the most effective and it is suggested that a quadrat of one mil-acre in size is likely to be the most generally convenient. The minimum amount of data which must be gathered in a pre-cutting survey is number per acre and distribution, or percentage of stocked quadrats per acre, of established seedlings and advanced growth; their size and vigour; abundance, height and vigour of shrubs and other competing vegetation; nature of seed bed; topography; drainage; soil moisture and texture; age or size and species of timber; stand density; the nature of the current seed crop and that of several previous years. In the case of a survey made 5, 10 or more years after cutting, the same data should be gathered on regeneration and competing plants, and topographical and soil conditions and, in addition, abundance,

distribution and state of decomposition of slash; density and vigour of residual stand, if any; size, abundance and distribution of seed trees; age of shrubs and competing trees; nature of seed crop at the time of and since cutting.

[1569]. 23.6 : 61.31. FARRAR, J. L. **Forest reproduction.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 936 (F–2), 1947. pp. 2.

A description of the methods of making a survey of forest reproduction (size of quadrats, amount of data, description of site types, identification of seedlings, etc.).

24. TENDING OF STANDS AND TREES

24.2. *Thinnings*

[1570]. 24.2 : 21.6. SINGH, P. **The conception and classification of thinnings.** *Indian For.* 73 (7), 1947 (315–22). (7th All-India Silvicultural Conference (1946), Dehra Dun.)

The author analyses and criticizes current theory and practice of thinning and proposes a new tree classification as a basis for rational thinning, taking the spread of the free crown as the governing factor. The proposed classes are as follows:—I. Spaced (trees with spread of free crown about equal to that of an average tree; includes over-spaced trees); II. Subspaced (trees with free crown spread about half of normal); III. Unspaced (trees with negligible or much reduced free crowns); IV. Ousted (trees with no free crown or vigour); V. Dead and dying. Within the first 3 of these classes three sub-classes (*a*) good, (*b*) fair, and (*c*) bad, based on stem quality, may be recognized. On the basis of this double classification, trees may be arranged in the following order of urgency of removal: V; IV; IIIc, IIc, Ic; IIIb; IIIa; IIb; IIa; Ib; Ia. In accordance with the importance which he attaches to the conception of freedom of crown, rather than dominance, as the ruling factor in determining thinning grades, the author deprecates the usual practice of representing thinnings diagrammatically in elevation only, and urges that the only satisfactory method of representing changes in the canopy diagrammatically, is in plan.

[1571]. 24.2 : 12.25 (68). **Research on thinning.** *Rep. Dep. For. S. Afr. 1946*, 1947 (6).

In the project on thinning of *Pinus patula* at Zoutpansberg the mean height and d.b.h. of dominants were 46 ft. and 10·3 in. respectively at 8¼ years old. It has been established that under these conditions the dominants in a stand of 1,200 trees per acre are significantly suppressed from the 3rd year onwards, the dominants in 600 trees from the 4th year, in 400 trees from the 5th year, in 300 trees from the 6th year, in 200 trees from the 7th year, in 150 trees from the 8th year, and in 100 trees from the 9th year. Similar results have been obtained from comparable projects throughout the Union.

[1572]. 24.2 : 12.25 : 11.49.5. ROE, E. I. **Thinning in Cedar swamps.** *Tech. Notes Lake St. For. Exp. Sta.* No. 279, 1947. p. 1.

Experiments in thinning *Thuja occidentalis* growing on well drained peat in Michigan showed that thinning was both beneficial and economically practicable. Thinnings should be confined to the better drained swamps; a 60-year-old stand with the water table practically at the surface of the peat showed no response to thinning.

[1573]. 24.2 : 12.26–8. SAGREIYA, K. P. **Single stem silviculture (thinning in Teak plantations).** *Indian For.* 73 (7), 1947 (323–9).

Continuing a previous article [cf. *For. Abstr.* 8 (No. 2410)] the author describes how the normal N/D curve could be used as a guide (*a*) to thin Teak plantations and (*b*) to measure and control the 'degree' [intensity] of thinning.

[1574]. 24.25 : 52.3 : 12.26–8. LOSITSKI, K. B. Izmenenie polnodrevesnosti derev'ev duba pri rubkakh ukhoda. [**Change in the taper of Oak trees as a result of thinnings.**] *Lesnaya Prom.* 1947 (2), (10–12). [Russ.]

A sample plot was laid out in 1932 in a 75-year-old Oak/Hornbeam stand [*Quercus robur s.l.* and *Carpinus betulus*], and light, medium and heavy thinnings were made, removing respectively 22, 35 and 53 per cent. by volume. From data collected in 1939, tabular and graphical comparisons are presented of the mean diameter increment of 25 trees in each sub-plot at breast height, and ¼, ½ and ¾ of total height, for the 7-year periods preceding and following the operation. The results indicated that whereas taper was little affected by light or medium thinnings, it was increased by heavy ones. Analysis by tree classes showed that

rate of increment at different heights up the stem depended to a greater extent on thinning grade than on tree class. Within a given thinning grade, rate of increment fell more rapidly with height up the stem for the trees that gave the greatest growth response after thinning (Kraft classes IV and III). In the trees of best quality, form, and development (classes I and II), taper was practically unaffected by light and medium thinnings. It is recommended on the basis of these results that not more than 30 per cent. of the initial volume should be removed in thinning.

24.4. *Shelterbelts. Windbreaks*

[1575]. 24.4 (477). HARALAMB, A. Perdele de protecție în Sud-Vestul Transnistriei. **[Shelterbelts in south-west Moldavia.]** *Rev. Pădurilor* 54 (5/6), 1947 (187–95). [Rum.f.]

Description of 5 shelterbelts for the protection of agricultural crops, in the south-west of Moldavia, between the rivers Dniester and Bug. The three species chiefly used are *Prunus armeniaca* and *Elaeagnus angustifolia* on the margins and *Robinia pseudoacacia* in the middle. Other species used are *Acer negundo*, *Sophora japonica*, *Acer pseudoplatanus*, *Gleditsia triacanthos*, *Koelreuteria paniculata*, *Ailanthus glandulosa*, *Fraxinus excelsior*, *Caragana arborescens*, and *Amorpha fruticosa*. The shrubs, of which *A. fruticosa* is the chief, are of great importance both to nurse the principal species and to thicken the lower parts of the shelterbelt.

24.5. *Pruning*

[1576]. 24.51. BARTH, A. Om kunstig kvisting som middel i kvalitetsproduksjonens tjeneste. **[Pruning as a means of producing good quality timber.]** *Tidsskr. Skogbr.* 53 (7/8), 1945 (113–41). [Nor.]

Emphasizes the importance of good pruning and gives instructions for pruning different species of trees, with suggestions for the selection of suitable trees, price tables and examples illustrating the financial advantages of pruning.

[1577]. 24.51 : 12.25 : 76. PAȘCOVICI, N. Ameliorarea arboretelor de molid, prin elagarea crăcilor uscate. **[Improving Spruce stands by pruning dead branches.]** *Rev. Pădurilor* 57 (1/3), 1945 (23–7). [Rum.f.]

An analysis of the labour and cost involved in pruning dead branches of Spruce from pole stage to middle age. In the pole stage the operation, which takes 45 man hours per ha., can be combined with thinning. Later operations take only 25–30 man hours per ha. Pruning should be done in the spring before growth begins.

[1578]. 24.51 : 12.25 : 33.03 : 82. **Contract pruning on the Ochoco.** *Timberman* 48 (12), 1947 (48).

In order to improve the pure Ponderosa Pine stands in the Ochoco National Forest, by providing peeler logs for the next cutting cycle, a contract pruning programme is being carried out. The trees to be pruned are first marked by Forest Service officers. Each contract specifies a definite number of trees in an area and carries a time limit for completing the pruning. The contractors are paid by the tree. Trees are pruned to 10 ft., in order to provide one clear 8-ft. veneer log at maturity. It was found that a man can prune three trees to 10 ft. for every one pruned to 18 ft. to produce two clear 8-ft. logs; thus pruning to the lower height produces half as much again in volume of clear timber within the limits of time and economic cost. The average man prunes about 100 trees per 8-hour day. In addition to pruning, the contractor must remove all small trees under 3 in. diameter within a radius of 3 ft. of the select tree. Foresters check the work once a month, and the contractor is paid for trees satisfactorily pruned.

[1579]. 24.51 : 07.7 : 12.25 : 46. **[Pruning of Douglas Fir.]** *Rep. B.C. For. Serv. 1946*, 1947 (19–20).

In 1942 the dominant trees in a plantation on a very good site at Green Timbers Forestry Station, B.C., were pruned to 7 ft. high in a test of tool efficiency [cf. *For. Abstr.* 5 (33)]. The study of methods was continued with a second pruning from 7 ft. to 13 ft., four years later, when the stand was in its 17th year. It was confirmed that Douglas Fir should not be pruned above half the height of the tree; some trees pruned when too small were lost. In the 1942 operation the low pruning averaged 6·4 minutes per tree (pruning and walking between trees); undergrowth is now much less dense

and for the current pruning from 7 to 13 ft. by ladder and hand-saw, pruning and walking time averaged 5·6 minutes per tree, and saw-cleaning and resting took another 0·7 minutes. Pole saws were less satisfactory, in this still dense stand, than ladder and hand saw, total time per tree being 13 per cent. more. Ladders were quicker and less laborious than climbing.

A history of the rate of healing has been kept for two branches on each of 80 trees pruned to 7 ft. high. After two seasons of growth, healing was complete on both sides of 9 per cent. of the trees, and one knot was completely covered on 4 per cent.; one year later the figures were 50 and 15 per cent. respectively. Healing is most rapid on trees pruned tangentially to the bole, slightly less when the collar of bark at the base of branches is left, and much slower when pruned with shears or axes.

27. TREATMENT OF DEFECTIVE OR EXCESSIVELY OPEN STANDS

[1580]. 27 : 23.1 : 23.53 (771). PATON, R. R. **Restoring forest conditions in an open wood.** *Bi-m. Bull. Ohio agric. Exp. Sta.* 31 (243), 1946 (170–6).

A heavily grazed area of mixed hardwoods in Ohio was fenced against livestock, and various methods of re-establishing forest conditions were tested, namely (1) natural regeneration alone, (2) with removal of weed trees, (3) followed by disking, (4) supplemented with broadcast sowing, spot sowing, or planted seedlings. It was found that natural regeneration following exclusion of livestock, was sufficient to produce adequate restocking without any auxiliary measures. Disking did more harm than good.

3. FOREST UTILIZATION. FOREST TECHNOLOGY

[1581]. 3. HALL, J. A. **Forest utilization.** *Unasylva* 1 (1), 1947 (12–26).

[1582]. 3 (431–5) : 2. WINSLOW, C. P., and COLEMAN, D. G. **Summary of investigators' reports on technical industrial forest products developments in Germany.** U.S. Forest Products Laboratory, Madison. 1946. pp. 27 + [32] + 6.

A summary of findings published in detail in Britain in the reports of the Combined Intelligence Objectives Sub-committee and the British Intelligence Objectives Sub-committee, London, and in the U.S.A. by the office of the Publication Board, Washington.

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

[1583]. 31 : 01.2. NORMAND, D. Lexique illustré des termes utilisés dans la description des bois. **[Illustrated dictionary of the terms used in the description of wood.]** Ministère de la France d'outre-mer, Paris. 1946. pp. 23 + 8 plates. [F.]

31.0. *General Information on Woods*

See also *For. Abstr.* 9 (Nos. 1502, 1513, 1538, 1629).

[1584]. 31.0 (69). NORMAND, D., and BESSON, A. Caractéristiques de quelques bois des Comores. **[Characteristics of some timbers from the Comoro Islands.]** *Agron. trop.* 2 (7/8), 1947 (399–405). [F.]

Anatomy, physical, mechanical and chemical properties of spp. of *Gambeya*, *Mespilodaphne*, *Trema*, *Brachylaena*, *Strychnos*, *Evodia*, *Weinmannia*, *Eugenia*, *Khaya* and indeterminate genera of Loganiaceae.

[1585]. 31.0 (81) : 34.2 : 02.41. Essencias florestais de valor economico. **[Forest species of commercial value.]** *Brasil madeireiro* 2 (18), 1946 (7–11). [Port.]

An alphabetical list of Brazilian species by vernacular names, giving also scientific names, habitat in Brazil and commercial uses of the timber and other products.

[1586]. 31.0 (91) : 33.32.1 : 33.14 : 33.38.1 : 33.15.1. SPOON, W. Onderzoek van een negental snelgroeiende Indische houtsoorten op hun bruikbaarheid voor de industrie. **[Research on the suitability of nine rapid-growing East Indian woods for industrial uses.]** *Tectona* 37 (3/4), 1947 (73–87). [Du.du.]

A summary of previously published information on the general properties and suitability for the manufacture of pulp, matches, charcoal and veneer, of *Albizzia falcata*, *Aleurites moluccana*, *Alstonia scholaris*, *Anthocephalus* spp., *Gossampinus heptaphylla*, *Guazuma ulmifolia*, *Melia azedarach*, *Sterculia foetida* and *Trema* spp. Properties and test results are presented in 4 tables. [Cf. *For. Abstr.* 7 (No. 1892); 8 (No. 2612); 9 (No. 440).]

[1587]. 31.0 : 12.25 (410). SMITH, J. T. **Utilization of home-grown Larch in Great Britain.** *Forestry* 21 (1), 1947 (77–91 + plates).

Covers the following topics: thinnings, rustic work and use of thinnings, mining timber, charcoal, paper-making, bark, poles, sawlogs, constructional timber, wood wool, firewood, sawdust and shipbuilding. Specifications of Larch (*Larix decidua*) as used in Great Britain are given in an appendix.

[1588]. 31.0 : 12.26–8. **Specimen woods, No. 141: Lapacho (*Tabebuia* spp.).** *Suppl.* to *Wood* 9 (12), 1947 (253–4).

[1589]. 31.0 : 12.26–8. Movingui. **[*Distemonanthus benthamianus.*]** *Bois For. Trop.* No. 2, 1947 (59–62). [F.]

[1590]. 31.0 : 12.26–8. Niove. **[*Staudtia gabonensis* and *S. kamerunensis.*]** *Bois For. Trop.* No. 2, 1947 (63–6). [F.]

31.1. *Structure. Anatomy. Identification*

[1591]. 31.1 (485). THUNELL, B., and PEREM, E. Identifiering av träslag. **[Identification of woods.]** *Medd. svenska Träforskn-Inst. (Trätekn. Avd.)* No. 12, 1947. pp. 12. [Sw.] *Repr.* from *Trävaruindustrien* 1947 (10). P.R.

Illustrated description of the perforated-card key in use at the Swedish Wood Research Institute, with 64 micro-photographs of Swedish and other woods.

[1592]. 31.1 (54). CHOWDHURY, K. A. **Regional keys for the identification of important timbers used in military areas of inspection. Parts I, II, and III.** *Indian For. Rec.* (*n.s.*) *Utilization* 3 (7), 1945. pp. 67 + 57 plates.

Keys for the identification of the most important timbers of the Bengal, South India, Bombay, Central, and Northern India areas, together with descriptions and photographic plates of 114 species of timber.

[1593]. 31.1 : 31.27. THUNELL, B. Undersökning av cellbyggnadens reaktion för tryckpåkänningar på furu-, björk-, och ekvirke. **[Investigations on the reaction of the cell-walls to compression forces in Scots Pine, Birch and Oak.]** *Medd. svenska Träforskn-Inst.* (*Trätekn. Avd.*) No. 13, 1947. pp. 10. [Sw.sw.e.] P.R.

In practically all the experiments made for the purposes of this investigation, the secondary wall was the first to give way to stresses. Deformations in the intercellular layer only occurred at high pressures. Low stresses produce fine transverse cracks, increasing in number with the pressure, in the cell walls. When the pressure is longitudinal or tangential to the fibres, most of the stress will be taken by the summerwood, but when radial by the springwood. In the first 2 cases the summer- and in the last the springwood will therefore be subject to greater deformation. The fact that the deformation takes place in the cell walls and not in the intercellular layer is of importance in the manufacture of improved wood, since it means that the cell wall can be reinforced with strengthening material. There are 65 illustrations.

[1594]. 31.1 : 12.25. DOLMETSCH, H. Über den Feinbau der Holzfaser. **[On the fine structure of wood fibres.]** *Kolloid-Zschr.* 108 (2/3), 1944 (183–92 + 4 plates). [G.] O.R.S.

Developing and fully grown cells of Spruce wood and partially delignified Spruce cellulose were examined in order to analyse the wall structure of the tracheid.

[1595]. 31.1 : 12.26–8. VINTILĂ, E., and GALBENU, E. Contribuțiuni la cunoașterea structurii lemnului de salcâm. **[Wood structure of *Robinia pseudoacacia*.]** *Rev. Pădurilor* 56 (7/9), 1944 (170–82). [Rum.f.]

Report on a study of the formation of tyloses, length and thickness of fibres, size of vessels and of medullary rays in wood of *Robinia pseudoacacia* grown in different conditions: (1) from a tree grown from seed in full light, (2) from a suppressed tree, and (3) from a tree originating in a coppice shoot after a 3rd coppicing.

[1596]. 31.1 : 12.26–8. CHOWDHURY, K. A. **Initial parenchyma cells in dicotyledonous woods.** *Nature, Lond.* 160 (4070), 1947 (609).

The author has recently examined some wood specimens of *Gmelina arborea* which show not only diffuse-porous and ring-porous structure, but also some intermediate stages between these two extremes. Thus, the timber (1) remains a diffuse-porous wood but, between the early fibres and the late fibres of the previous year, a thin layer of initial parenchyma cells is usually present; (2) shows a semi-ring-porous structure, with the somewhat large and scattered early vessels partially embedded in the initial parenchyma cells; (3) shows a true ring-porous structure, where a clear row of large vessels are partially or wholly embedded in the initial parenchyma. Similar phenomena have been observed in many diffuse-porous woods and it is suggested that the initial parenchyma cells are often a generic and may in some cases be even a family character.

31.2. *Physical Properties*

[1597]. 31.2 : 12.25 (470). TIMOFEEV, V. P. Tekhnicheskie svoystva drevesinȳ listvennitsȳ. **[Physical and mechanical properties of Larch wood.]** *Trud. sel.-khoz. Akad. Timiryazeva, Moskva* No. 30, 1945 (129–44). [Russ.] C.G.B.

A report on tests of plantation-grown wood of European and Siberian Larches, Scots Pine and Norway Spruce from the experimental forest of the Moscow (Timiryazev) Academy of Agriculture [for mensurational data on the same plantations see *For. Abstr.* 7 (No. 1433)], the samples being taken from trees 64–69 years old on permanent plots in even-aged plantations from which nothing but dead trees had ever

been cut. The values obtained for the properties studed were: (1) *Specific gravity* (at 15 per cent. moisture content): Pine 0·42 ± 0·01, Spruce 0·40 ± 0·01, European Larch 0·54 ± 0·01, Siberian Larch 0·65 ± 0·01. (2) *Resistance to compression parallel to the grain* (at 15 per cent. moisture, in kg./sq. cm.): Pine 314·1 ± 6·0, Spruce 368·5 ± 6·2, European Larch 414·4 ± 6·2, Siberian Larch 540·9 ± 7·9. (3) *Resistance to static bending* (at 15 per cent. moisture, in kg./sq. cm.): Pine 594·1 ± 21·1, Spruce 606·1 ± 17·2, European Larch 828·9 ± 17·3, Siberian Larch 1020·3 ± 11·0. (4) *Resistance to impact bending* (in kg./sq. cm.): Pine 0·27 ± 0·02, Spruce 0·22 ± 0·01, European Larch 0·40 ± 0·02, Siberian Larch 0·35 ± 0·02.

The values obtained are compared with data from literature on both plantation and naturally grown material of the same species in the U.S.S.R. Such data are scanty in the case of European Larch. For the remaining species Perelygin has published the average values for wood grown in natural forests of Russia in Europe, and taking these as unity for each of the properties concerned, the relative values recorded in the present tests are: *Specific gravity*—Pine 0·87, Spruce 0·85, (Siberian) Larch 0·97. *Resistance to compression parallel to the grain*—Pine 0·73, Spruce 0·91, Larch 1·06. *Resistance to static bending*—Pine 0·72, Spruce 0·80, Larch 1·04. *Resistance to impact bending*—Pine 1·29, Spruce 1·23, Larch 1·24. It should be noted that Perelygin's figures relate to wood from 80- to 250-year-old trees, and that as the maximum values are reached at about 80 years, those of the plantation trees may be expected to show some further increase with age.

Data are also included on the calorific values, ash content and specific heating effects of the material, with tests made on Birch and Oak for comparison. Siberian Larch showed the highest ash content (0·54 per cent. based on oven-dry weight).

[1598]. 31.2 : 12.26–8 (498) : 31.1. VINTILĂ, E. Cercetări cu privire la insușirile technologice ale lemnului de anin negru. **[Investigations into the working properties of the wood of *Alnus glutinosa*.]** *Rev. Pădurilor* 54 (7/8), 1947 (273–87). [Rum. rum.g.]

Data on form of trunk, percentage of bark, width of annual rings, density, shrinkage, and resistance to compression parallel with the grain for Rumanian-grown Alder, compared with Raunecker's figures for Bavarian-grown Alder.

31.22. Relation to Water, Air, Gases

See also *For. Abstr.* 9 (Nos. 1680, 1753, 1782).

[1599]. 31.22.2. PECK, E. C. **Shrinkage of wood.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1650, 1947. pp. 6 + tbls. + gphs. P.R.

A general review of the subject with tables of accumulated mean shrinkage values for North American species.

[1600]. 31.22.2 : 33.32.3. FRIEDRICH, K. Beitrag zur Messung der Quellung von Faserhartplatten und Holz. **[Contribution to the measurement of swelling in hard fireboard and wood.]** *Repr.* from *Holz Roh- u. Werkstoff* 6 (10/12), 1943 (283–8). [G.] *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 989, Item No. 22, 1946 (103–8). P.R.

An illustrated description of a measuring apparatus and an account, with tables and graphs, of experiments on specimens of fibreboard, Spruce, Pine, Beech and Elm, under varying conditions of humidity. Fibreboard, owing to the haphazard arrangement of the fibres, swells more in a lengthwise but less in a transverse direction than wood.

[1601]. 31.22.3 : 31.21.4. BURR, H. K., and STAMM, A. J. **Diffusion in wood.** *J. phys. colloid Chem.* 51 (1), 1947 (240–61). D.S.I.R.

Describes experiments to test theoretical expressions for the rates of passage of vapours, liquids and solutes through softwoods [see *For. Abstr.* 9 (No. 301)], by measuring relative electrical conductivities in the 3 structural directions. The longitudinal conductivities of 3 softwoods were in agreement with the predicted values, while transverse conductivities were 26–46 per cent. lower. In hardwoods the longitudinal values were slightly lower but followed a curve parallel to the theoretical one. The transverse conductivities were divided equally above and below the theoretical curve. Direct measurement of the rate of diffusion of sodium chloride tangentially and tests to establish the ratio of radial to tangential

diffusion show that the relative electrical conductivity is equal to the relative diffusion content. Microscopical measurements of the number of fibres per cm., of the double-cell-wall thickness and of the fractional pore volume of hardwoods vary widely and indicate why equations for the simpler softwoods apply less consistently to hardwoods.

31.23. Weight. Specific Gravity

[1602]. 31.23 : 33.32 : 31.22.1. **Specific gravity (or density) and moisture content of pulpwood.** *Paper Tr. J.* 125 (9), 1947 (33–6). P.R.

Describes methods of obtaining standard disks or chips as test specimens; also apparatus and methods for determining the moisture content and specific gravity from the moisture-free weight and the maximum (green) or minimum (moisture-free) volume.

31.27. Mechanical Strength

See also *For. Abstr.* 9 (Nos. 1593, 1597–8, 1672–3, 1681–4, 1760, 1774, 1776, 1841–3).

[1603]. 31.27 : 12.26–8 : 31.2. PERELYGIN, L. M. Sravnitel'nŷe fiziko-mekhanicheskie svoystva drevesinŷ yadra i zaboloni yasenya. **[Comparative physical and mechanical properties of Ash heartwood and sapwood.]** *Lesnaya Prom.* 1947 (4), (15–16). [Russ.]

Comparative tests were made of the sapwood and heartwood of Ash samples from 130-year-old trees in mixed hardwood stands in the Tellermann forest, Voronezh Province.

The results, which are tabulated in detail, showed that the physical and mechanical properties of the sapwood were inferior to those of the heartwood. The sapwood was narrower ringed, contained less latewood and was consequently lighter and more absorptive of moisture. Its radial and tangential shrinkage was smaller but its longitudinal shrinkage greater than that of the heartwood. The greatest disparity occurred in resistance to impact bending and modulus of elasticity (respectively 23·5 and 21·3 per cent. lower in sapwood), though values for crushing strength, tensile and shear strength parallel to the grain were also 10–14 per cent. lower in sapwood. Resistance to static bending, however, was practically identical for both types of wood. Values for all the properties studied decreased progressively with increasing distance from the centre of the stem, excepting only water absorption and shrinkage or swelling (which showed the converse tendency).

[1604]. 31.27 : 12.26–8. JOHNSON, R. P. A. **Mechanical properties of Aspen [*Populus tremuloides*].** *Lake St. Aspen Rep.* No. 7, 1947. pp. 16.

[1605]. 31.27. STÜSSI, F. Zum Einfluss der Faserrichtung auf die Festigkeit und den Elastizitätsmodul von Holz. **[The influence of fibre direction on the strength and modulus of elasticity of wood.]** *Schweiz. Bauztg.* 126 (22), 1945 (247–8). [G.] D.S.I.R.

Kollmann's equation for the influence on the stress in wood of the angle γ between incidence of the force and the direction of the grain is—

$$\sigma_\gamma = \frac{1}{\frac{\cos^n\gamma}{\sigma_{\parallel}} + \frac{\sin^n\gamma}{\sigma_{\perp}}} = \frac{\sigma_{\parallel}\sigma_{\perp}}{\sigma_{\perp}\cos^n\gamma + \sigma_{\parallel}\sin^n\gamma}$$

in which $\sigma_{\parallel}$ and $\sigma_{\perp}$ represent respectively the stresses parallel and perpendicular to the grain, and the index n varies with the type of loading and is usually not an integer. As this equation produces marked deviations from certain test curves and is unwieldy in practice, Stüssi would start from the equation

$$\sigma_\gamma = \phi_1\,\sigma_{\parallel}\cos^2\gamma + \phi_2\sigma_{\perp}\sin^2\gamma,$$

where ϕ_1 and ϕ_2 are reduction factors varying acccording to the wood structure and the type of load, and are determined empirically from test curves, ϕ_1 being unity when γ is zero and ϕ_2 unity when γ is 90°.

$$\text{If } \phi_1 = \frac{1}{\sqrt{1 + c_1\sin^2\gamma}} \text{ and } \phi_2 = \frac{1}{\sqrt{1 + c_2\cos^2\gamma}},$$

where c_1 and c_2 are constants for any given type of wood and must be determined experimentally, then

$$\sigma_\gamma = \sigma_{\parallel}\frac{\cos^2\gamma}{\sqrt{1 + c_1\sin^2\gamma}} + \sigma_{\perp}\frac{\sin^2\gamma}{\sqrt{1 + c_2\cos^2\gamma}}$$

Comparisons of the results from this formula with those from Kollmann's and with actual test results, show that the new equation is superior in accuracy to Kollmann's, is directly applicable to the calculation of permissible loads in cases where the permissible stresses parallel and perpendicular to the grain are

known, and expresses the dependence of elasticity factors on the angle γ with satisfactory accuracy.

[1606]. 31.27 : 12.25 : 12.26–8. GREEN, A. E., and TAYLOR, F. R. S. **Stress systems in aeolotropic plates. III.** *Proc. roy. Soc. Lond.* (*Ser. A*) 184 (997), 1945 (181–95). O.R.S.

The stress distribution round a circular hole in an infinite aeolotropic plate subjected to tension in one direction is found theoretically in the case when the material of the plate has two directions of symmetry at right angles to one another. Numerical work is carried out using the elastic constants found in experiments made with specimens cut from the highly aeolotropic woods, Spruce and Oak. An attempt is made to apply the calculated stress concentrations, in conjunction with measurements of ultimate strength, to determine the kind of failure that might be expected near a hole in a highly stressed wood plate. *Authors' summary.*

[1607]. 31.27 : 12.25. GREEN, A. E. **Stress systems in isotropic and aeolotropic plates. V.** *Proc. roy. Soc. Lond.* (*Ser. A*) 184 (998), 1945 (231–52). O.R.S.

A general theoretical solution is obtained for certain stress distributions in isotropic and aeolotropic plates containing holes of various types. The solution includes as special cases some well known results for isotropic materials, and it is used here to obtain new results for both isotropic and aeolotropic plates. Numerical results are given for the distribution of stress round the edges of an elliptical hole in a Spruce plank under tension, a square hole with rounded corners in an isotropic tension member and in an isotropic plate under shear, and a triangular hole with rounded corners in an isotropic tension member. *Author's summary.*

[1608]. 31.27 : 12.25. GREEN, A. E. **Stress systems in aeolotropic plates. VI.** *Proc. roy. Soc. Lond.* (*Ser. A*) 184 (998), 1945 (289–300). O.R.S.

The distribution of stress due to hyperbolic notches in an aeolotropic plank under tension or flexure is discussed theoretically when the plank has two directions of symmetry at right angles. Numerical work is carried out using the elastic constants found in experiments made with specimens cut in the longitudinal tangential plane from Spruce wood which is highly aeolotropic. The calculated stresses are used in conjunction with measurements of ultimate strength to determine the kind of failure which might be expected near notches in a Spruce plank under tension. *Author's summary.*

[1609]. 31.27 : 12.25. GREEN, A. E. **Stress systems in aeolotropic plates. VII.** *Proc. roy. Soc. Lond.* (*Ser. A*) 184 (998), 1945 (301–45). O.R.S.

The paper is divided into three parts. In Part I a general method of solution is given for problems of stress distributions in isotropic and aeolotropic plates containing a hole of a fairly general shape when the boundary values of the displacements are prescribed, but applications for aeolotropic plates are at present limited to circular and elliptical holes. Part II is concerned with distributions of stress in aeolotropic plates containing a single circular discontinuity or hole when the boundary conditions at the edge of the circle are of a mixed type, i.e. they involve both the displacements and the stresses. A set of fundamental stress functions is obtained which are used to investigate stresses due to bolts and knots in stressed planks, and the work is illustrated numerically for a specimen of Spruce wood. In Part III a general method of solution is given for problems of stress distributions in aeolotropic plates which contain any number of circular holes of varying sizes distributed in any manner. The solution is applied to the problem of two circular holes in a tension member, and a few numerical results are given for Spruce. *Author's summary.*

[1610]. 31.27 : 12.25. HOLGATE, S. **The transverse flexure of perforated aeolotropic plates.** *Proc. roy. Soc. Lond.* (*Ser. A*) 185 (1000), 1946 (50–69). O.R.S.

The problem of a thin aeolotropic plate containing a circular hole, and bent or twisted by the action of couples at infinity, is solved in a general manner, and the solution is used to find the concentration of stress couple around the edge of a circular hole in a Spruce plate in a number of fundamental cases. The work is then extended to apply to elliptical holes in aeolotropic plates, and a theoretical solution is obtained from the problem of a plate bent into the form of a cylinder whose generators are

parallel to the major axis of the hole. Numerical results are given for the distribution of stress couple along the edge of an elliptical hole in a Spruce plate bent in this manner. *Author's summary.*

[1611]. 31.27 : 33.12. LUXFORD, R. F., and KRONE, R. H. **End joints of various types in Douglas-fir and White Oak compared for strength.** *Rep. U.S. For. Prod. Lab., Madison* No. R1622, 1946. pp. 13 + tbls. + figs. P.R.

Tests of tension and compression strengths parallel to the grain in plain scarf joints of varying slopes, serrated and a square-toothed scarf, fingered and Onsrud joints. The results, given in a series of tables, indicate that plain scarf joints with a slope of 1 in 20 cause 5 per cent. reduction in strength in tension parallel to the grain in both Douglas Fir and White Oak. Increasing the slope reduced the strength still further. The several commercial-type joints were all less efficient in tension parallel to the grain than the plain scarf joint of a slope of 1 in 10. The efficiency of serrated, fingered and Onsrud joints in compression parallel to the grain was high.

[1612]. 31.27 : 33.4 : 38.2. STÜSSI, F. Ueber Grundlagen des Ingenieurholzbaues. **[The principles of wood engineering.]** *Repr.* from *Schweiz. Bauztg.* 65 (24), 1947. pp. 19. [G.] P.R.

Three problems affecting the wood structural engineer are considered:—(1) Theory and practice in estimating the rigidity and elasticity of wood [cf. *For. Abstr.* 4 (34)]. (2) Methods of calculating the strength of bolted members. (3) The construction of two-membered struts.

[1613]. 31.27 : 33.4 : 12.26–8. BULL, M. G. **Hardwood columns subjected to loads of short duration.** *J. Instn. Engrs., Aust.* 17 (3), 1945 (50–8). D.S.I.R.

The maximum load-carrying capacity of timber columns may be calculated by assuming certain limiting physical properties such as initial shape, excentricity of application of the load, Young's modulus and end conditions of restraint and by assuming also a relationship which will express the stress conditions that exist when maximum load-carrying capacity is reached. The author presents such a relationship between direct and bending stresses at maximum load. Originally derived for Spruce, its application to a series of tests on columns of Australian hardwoods subjected to loads of short duration is examined.

[1614]. 31.27 : 33.4. YLINEN, A. Über die Bestimmung der Spannungen und Formänderungen von Holzbalken mit rechteckigen Querschnitt. **[The determination of the stresses and deformation of wooden beams rectangular in cross-section.]** *Handl. Ing-VetenskAkad., Stockh.* No. 182, 1945. pp. 59. [G.e.] D.S.I.R.

A method for determining the deformations and stresses of a rectangular wooden beam when the annual rings are at right angles to the plane of the bending moment. From the elastic properties of a single annual ring, an equation is reached for the normal force arising in the annual ring, and the solution of this fundamental equation is given for six types of load, i.e. in cases of:—(1) Uniform bending; (2) bending of a cantilever loaded at the end; (3) bending of a beam loaded uniformly along its length; (4) bending of a beam by non-uniform load; (5) bending of a beam supported at both ends, load at centre; (6) a centrally loaded buckling beam.

The distribution of the bending stress over the cross-section, the shape of the cross-section after deformation, the distribution of the shearing stress as well as the curvature and deflection of the beam are systematically studied.

The method also offers a means of checking results arrived at by the elementary bending theory based on the hypothesis of Bernoulli.

31.3. *Chemical Properties*

See also *For. Abstr.* 9 (No. 1620).

[1615]. 31.3 : 12.25–8 (51). CHUNG, C. T. **Chemical analysis of Chinese wood.** *J. Chin. chem. Soc.* 9 (1), 1942 (90–2). [E.] O.R.S.

Ten Chinese species, including *Cupressus funebris, Betula luminifera, Alnus cremastogyne, Castanopsis platyacantha, Pinus massoniana,* were analysed for their moisture, ash, methoxyl group, lignin and α-, β- and γ-cellulose content and for parts soluble in cold and hot water, in ether and in 1-per-cent. NaOH.

[1616]. 31.3 : 12.25. ANDERSON, E. **The isolation of pectic substances from soft-woods.** *J. biol. Chem.* 165 (1), 1946 (233–40). L.S.

The presence of pectic substances in *Pseudotsuga taxifolia*, *Tsuga heterophylla*, *Thuja plicata*, *Pinus taeda* and *Picea mariana* was determined; although methods used were not quantitative it is thought that up to 0·5 per cent. of pectic materials may be present in softwoods. The wood was first converted to holocellulose and then extracted with a 2·5-per-cent. solution of ammonium hydroxide. By this process pectic materials could be isolated from smaller amounts of softwoods than other methods require.

[1617]. 31.3 : 12.25. HOLMBERG, B. Fichtenholz und Thiohydracrylsäure. [**Spruce wood and thio-hydracrylic acid.**] *Ark. Kemi. Min. Geol.* 21A (10), 1946. pp. 20. [G.] O.R.S.

Experiments to study the action of thiohydracrylic acid on Spruce wood, with an analysis of the lignin products.

[1618]. 31.3 : 12.26–8. WISE, L. E., and RATLIFF, E. K. **Summative analysis of Quebracho wood.** *Trop. Woods* No. 91, 1947 (40–5).

Extractives were determined in a sample of Quebracho (*Schinopsis* sp.) wood; the total of extraneous materials was about 37 per cent. The extractive-free wood residue was subjected to summative analysis, and the summation on an oven-dry, extractive-free basis was as follows: ash 0.75, lignin 23·9, α-cellulose 45·3, hemicelluloses 25·9, acetyl 1·6 per cent. The methoxyl content of the lignin (18 per cent.) was lower than is usual in woods of angiosperms of North America and Europe and the acetyl content was also atypically low. Xylose could be isolated in quantity from the hemicelluloses.

[1619]. 31.3 : 33.32.1. WISE, L. E., and RATLIFF, E. K. **Quantitative isolation of hemicelluloses and the summative analysis of wood.** *Anal. Chem.* 19 (7), 1947 (459–62). P.R.

Describes the separation of holocellulose, obtained by digesting wood with acetic acid and sodium chlorite, into α-cellulose and its non-cellulosic components by means of graded extraction with aqueous potassium hydroxide in an atmosphere of nitrogen, and tabulates the results of summative analysis into: (1) ash, lignin, α-cellulose, the hemicelluloses and acetyl, and (2) ash, lignin, mannan, pentosan (calculated as xylan), uronic anhydride, acetyl, CH_2 and α-cellulose corrected for mannose, xylose and uronic-acid units. Discusses the terms 'α-cellulose' and 'true-cellulose'.

31.4. *Durability. Decomposition*

See also *For. Abstr.* 9 (No. 1673).

31.42. Attack by Plant Organisms

See also *For. Abstr.* 9 (Nos. 1741, 1748, 1774).

[1620]. 31.42 : 34.6 : 31.3 : 12.21. JACOBS, S. E., and MARSDEN, A. W. **The rôle of antibiotics in the decomposition of sawdust. I. Inhibition of the growth of cellulose decomposing bacteria.** *Ann. appl. Biol.* 34 (2), 1947 (276–85). O.R.E.

Sawdust from mixed coniferous species was extracted with water or a mildly alkaline solution of inorganic salts and a study made of the extractive for its inhibitory action on the growth of cellulose-decomposing bacteria of the genera *Sporocytophaga* and *Cellulomonas*. The extracted material is acidic but remains active even after neutralization, especially towards *Sporocytophaga*. Sawdust that has been extracted with water or alkaline solution, or has been neutralized, no longer prevents the growth of *Cellulomonas*, although there is a delay before the attack becomes evident, but *Sporocytophaga* is still completely inhibited under all three conditions. The inhibitory action seems therefore to be of two kinds, one due to hydrogen ions and the other to a specific substance or substances. It is possible that the specific antibiotics in sawdust are of the type which are more active under acid than under alkaline conditions. Acidity seemed to be the main reason why *Cellulomonas* did not survive in untreated sawdust and failure to recognize the acidic nature of sawdust may be responsible for conflicting reports on its value in increasing the humus content of soils.

[1621]. 31.42.1 : 12.25 : 11.44 : 12.11.1. NIKOLAEVSKAYA, M. A., and CHASTUKHIN, V. YA. Mikroflora elovoy drevesinȳ na raznȳkh fazakh raspada. [**The microflora of Spruce wood in different phases of decay.**] *Pedology* 1945 (8), (403–12). [Russ.e.] [Mordovski Gosudarstvennȳ Zapovednik.] H.S.B.

In continuation of previous work on the decomposition of plant remains in natural

Spruce forest [see *For. Abstr.* 7 (No. 1574)] this paper describes the succession of fungi and bacteria in Spruce wood sampled at different stages of decay and placed on nutrient media in the laboratory. The following phases are recognized: (1) That of the staining fungi (species of *Ceratostomella*, and *Cladosporium*, etc.) plus protein-decomposing bacteria (*Pseudomonas fluorescens*, *Achromobacter pestifer*), and *Penicillium* spp. accompanying the developing mycelia of basidiomycetes. (2) The 'brown rot' stage, characterized by vigorous development of wood-destroying basidiomycetes, especially *Fomes pinicola*, together with fungi such as *Penicillium* spp., which can live on either cell contents or the intermediate products of decomposition produced by the basiodiomycetes. The *Penicillia* secrete quantities of organic acids, and owing probably to these, bacteria are completely absent. (3) The 'red rot' stage in which *Fomes pinicola*, having used the nutrients available to it, gradually dies off with autolysis of the hyphae, liberation of ammonia and consequent alkalinification of the medium, and gives way to cellulose decomposers such as species of *Trichoderma*, *Haplographium* and *Sporotrichum*, with Mucoraceae and a very rich bacterial flora including ammonifying and denitrifying forms, as well as anaerobic nitrogen fixers. The acid-forming *Penicillium* spp. disappear in this stage.

[1622]. 31.42.11 : 12.11.15 : 12.21. NORD, F. F., and VITUCCI, J. C. **Enzyme studies on the mechanism of wood decay.** *Nature, Lond.* 160 (4059), 1947. (224–5). [Fordham Univ., New York, N.Y.]

As a result of further studies of *Merulius niveus*, *M. tremellosus*, *M. confluens*, and *Fomes annosus* [cf. *For. Abstr.* 8 (No. 303)] the authors postulate a mechanism for the breakdown of the cellulosic fraction of wood by the action of these fungi, according to the following sequence: cellulose → glucose → ethyl alcohol → acetic acid → oxalic acid.

31.43. Attack by Animal Organisms

See also *For. Abstr.* 9 (Nos. 1741, 1743–5).

[1623]. 31.43 : 12.26–8 : 13.2 (667). LOGAN, W. E. M. **A preliminary investigation into borer attack of *Triplochiton scleroxylon* lumber in the Gold Coast.** *Fm. & For.* 7 (2), 1946 (114–6).

As a result of the investigations here reported, the following conclusions are tentatively put forward. Sapwood of converted Wawa (*Triplochiton scleroxylon*) is very susceptible to attack by the Bostrychid beetles *Apate tenebrans* and *Heterobostrychus brunneus*, but heartwood seems to be immune or nearly so; it is possible that heartwood is not attacked so long as sapwood is available. Attacks may take place at any time from 2 days to 4 weeks and even occasionally up to 4 months after conversion. Both beetles and larvae appear to bore. Brushing with weak sodium-fluoride solutions (2 per cent. and 5 per cent.) seems to have no significant preventive effect. It is recommended that, as far as possible, utilization of Wawa should be restricted to the heartwood, and logs extracted, converted and seasoned as quickly as possible after felling. Where delay is unavoidable, water storage may prove effective against infestation, but more information is required on this point. Stacked lumber should be examined periodically and any infested pieces removed and burnt. The drying racks, stickers, etc., should themselves be constructed of heartwood, and preferably impregnated with creosote.

[1624]. 31.43 : 13.2 (81). ALMEIDA, D. G. DE. Madeiras imunes ou muito resistentes ao cupim. [**Woods immune or highly resistant to termite attack.**] *Rev. flor., Rio de J.* 5 (2), 1946 (13–23). [Port.] Also in *Brasil madeireiro* 3 (26), 1947 (10–21).

An account of experiments in Brazil to determine the termite resistance of certain untreated indigenous woods. Includes a list of 181 Brazilian species, the heartwood of which is immune or highly resistant. [Cf. *For. Abstr.* 8 (No. 2588).]

[1625]. 31.43 : 12.26–8 (88 : 91) : 31.41. La résistance des bois exotiques aux xylophages. [**The resistance of exotic timbers to marine borer attacks.**] *Rev. int. Bois* 14 (122/123), 1947 (156–7). [F.]

Summary of a report on tests of timbers from the Netherlands East Indies and Guiana for resistance to attack by *Teredo* and *Martesia*. Specimens were exposed at various points on the Dutch coast, in the Celebes and in Surinam in 1938. The war interrupted the experiment in the Celebes, but the others were continued until 1943. The following results were obtained (figures in brackets indicate percentage

silica content of the wood): *Metrosideros* spp. (0·58 and 0·48) negligible attack; *Ocotea rodiaei*, slight attack by *Martesia*, severe attack by *Teredo*; *Dicorynia paraensis* (0·5), severe attack by *Martesia*, very slight attack by *Teredo*; *Eusideroxylon zwageri*, completely destroyed by *Teredo*, slight attack by *Martesia*. *Shorea laevifolia*, negligible attack after 3½ years' exposure. Douglas Fir, Willow and Oak, which were exposed for purposes of comparison, were practically destroyed by *Teredo*, but not by *Martesia*.

[1626]. 31.43 : 13.2 : 13.15. BUKHALOVA, V. I., and DMITRIEV, A. P. Drevotochets *Limnoria* v Belom More. [**The borer *Limnoria* in the White Sea.**] *Priroda, Moskva* 33 (5/6), 1944 (119–20). [Russ.] C.G.B.

In contrast to observations by R. Coker in N. Carolina, it was found in the Kovdovsk bay (White Sea) that the marine borer *Limnoria lignorum* produced as many as 12–20 (sometimes 25) eggs per female and that its reproduction was possible at a temperature as low as 8–10° C. In this locality, at the mouth of the river Kovda, the salinity is too low for the borer to attack piles, etc., and it lives in the more saline water at greater depths (7–9 m.), feeding on the sunken waste from sawmills in the vicinity. It is feared that from this centre attacks may spread to marine wooden constructions in places where salinity is higher.

31.45. Injury by Fire

See also *For. Abstr.* 9 (Nos. 1741, 1751).

[1627]. 31.45 : 31.24. BAMFORD, C. H., CRANK, J., and MALAN, D. H. **The combustion of wood. Part I.** *Proc. Camb. phil. Soc.* 42 (Pt. 2), 1946 (166–82). L.S.

Investigations made into methods of calculating the temperatures and rates of decomposition inside a mass of material, the thermal breakdown of which is accompanied by a heat change, given an initial set of conditions and a known rate of supply of heat to the surface. The paper aims at solving this problem for sheets of wood heated in a simple manner and gives experimental curves and formulae.

[1628]. 31.45 : 33.4. JOHANNESSON, P. Redogörelse för några utförda provningar av branddörrar. [**Account of some tests of fire-doors.**] *Medd. ProvnAnst., Stockh.* No. 94, 1944. pp. 19. [Sw.e.]

Describes fire tests of steel, tin-clad wood-core, and concrete doors. The doors were exposed to heat on one side, the temperature being raised, as far as possible, in accordance with the normal fire temperature curve. The wooden doors consisted of a core of Pine planks with a first coat of 3-mm. asbestos board and an outer coat of 0·7-mm. sheet-metal. The doors had good insulating capacity for the first hour, but when the wooden core became heated, smoke and combustible gases quickly developed and ignited after about 15 minutes. Two wooden doors of this type together proved even less suitable. An explosive mixture of gases easily arises between the doors and ignites, sending out flames to the side away from the fire.

32. HARVESTING OF WOOD. LOGGING

See also *For. Abstr.* 9 (No. 1498).

[1629]. 32 (675) : 33.17 : 35 : 31.0 : 33.3 : 81 : 09.4. JASSOGNE, F. L'exploitation forestière au Congo Belge. [**Forest exploitation in the Belgian Congo.**] J. & A. Janssens, 16 Rue Emile Feron, Bruxelles. 1945. pp. 192 + plates + maps. [F.] L.S.

A fairly detailed account of the history, methods, and statistics of forest exploitation in the Belgian Congo, including woods operations, sawmilling, timber trade, classification and properties of timber, chemical treatment of wood, the system of licences and concessions and the organization of the Forest Service. The last 60 pages or so consist of detailed descriptions of some 30 of the more important commercial species. A table shows the various uses of Congo woods in Europe.

32.1. *Marking of Trees and Coupes*

[1630]. 32.1 : 76.1. NICKERSON, D. E. **Cost of marking standing timber.** *For. Chron.* 23 (3), 1947 (234–5).

A study was made of costs of marking standing timber in an area of 173 acres in New Brunswick, of which 67 per cent. was two-storey mixed stands and the remainder equally divided between mature hardwoods and mature softwoods. The work took 254 man-hours

(using two markers and a tallyman), i.e. 0·63 acres were marked per man-hour. In an 8-hour day, a 3-man party could be expected to mark about 83 cords of large Balsam Fir on 15 acres. If labour could be obtained for $5 per day for this work, the labour would cost $1 per acre or 18 cents per cord. To this must be added about 3 cents per cord for paint. Paint was a more expensive item than had been expected. A low grade of yellow house paint was used, but it was found that this would stand little dilution; about one part of kerosene to 3 parts of paint was found to be the maximum.

32.2. *Felling and Related Operations*

See also *For. Abstr.* 9 (No. 1654).

[1631]. 32.2 : 07.7 : 32.9. FOGH, I. F. **Mechanical logging.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 938, 1947. pp. 6.

A review of the factors involved in achieving the object of mechanical logging, i.e. the harvesting and transport of pulpwood or logs from stump to landing, entirely by mechanical means. The first necessary step, the development of a practical power saw for general pulpwood cutting, has not yet been achieved; the power saws at present on the market being heavy, cumbersome, complicated, expensive and unreliable. It is believed that this phase of mechanical logging must await the evolution of some form of light saw, with a reciprocating blade, operated by either air or electric power.

Skidding of trees, logs or pulpwood to roads spaced as far apart as possible is the next stage. Tractor skidding has not proved very satisfactory for pulpwood. High-lead skidding with winch or donkey has given fairly good results, but the distance over which it is possible to operate is certainly not over 350 ft. and averages not more than 300 ft. The Canadian International Paper Company has been experimenting in the use of a skyline to increase the possible skidding distance. Results to date have been encouraging and demonstrate that tree lengths may be skidded over distances up to 650 ft. without getting caught up, and that the skyline may be attached to trees as small as 8 in. d.b.h. as back spars, without pulling them down. Production with one machine and a 7-man crew has been established at 20 cords a day delivered on roadside and it is believed that 30 cords a day over a distance of 800 ft. could be achieved with a properly designed machine and an efficient crew. Skidding costs in these conditions should be about $2·25 per cord.

The question where to cut the tree-lengths into logs or pulpwood is of great importance. The possibilities are to haul the trees to the landing and cut them there; to haul them with tractor and arch to a mechanical saw on the main haulage road, and then load the logs and pulpwood on trucks for haulage to the landing; or, finally, to concentrate the trees in large piles with a self-propelled combined slasher and loader moving from pile to pile cutting up the trees and loading the logs or pulpwood. This last method, by eliminating the tractor, is the most promising. Experiments revealed various difficulties in operation and indicate that smaller piles should be made, that the trees should be skidded into the piles in a direction opposite to that from which they will be removed, and that piles should not be accumulated and left exposed to the action of frost or to covering by snow.

[1632]. 32.2 : 07.7 : 32.9. SIMMONS, F. C. **Mechanizing forest operations.** *Timber of Canada* 8 (3), 1947 (26–7, 82–5).

A brief review, with illustrations, of some recent mechanical logging devices, including mechanical loaders, self-loading trucks, barkers and portable mechanical saws.

[1633]. 32.25 : 07.7. KNAPP, G. E. **'Dixie logger' power saw.** *Mechaniz. Manual Sth. Pulpwood Conserv. Ass.* No. 32, 1947. pp. 2. P.R.

Describes and illustrates a circular felling and crosscutting power saw for use by a single operator. The mandrel is mounted on a bronze slip sleeve at the axle so that it can be locked to give any height of saw desired. For cutting a low stump, the mandrel fits into a U-shaped slot on the axle.

[1634]. 32.25 : 07.7 (498). MÜLLER, R. Fierăstraiele cu motor la pădure. **[Power saws in the forest.]** *Rev. Pădurilor* 55 (5/6), 1943 (213–21). [Rum.g.]

[1635]. 32.25 : 07.7 : 82. AZLETSKI, B. A. Rabota shest'yu-vosem'yu elektropilami ot odnoy elektrostantsii. **[Operation of 6–8 electric saws from a single power unit.]** *Lesnaya Prom.* 1947 (3), (11–12). [Russ.]

In the logging trials made, the workers were split into two groups, working on opposite

sides of the horse tramway used for extraction, each group consisting of 3–4 gangs (with one power saw per gang, each of 3–4 men). For alternate hours of the day a group was engaged in (*a*) trimming felled stems, and (*b*) cross-cutting, moving logs to the tramway, and felling fresh trees. Stages (*a*) and (*b*) were staggered between the groups and hence the full capacity of the power unit could be employed throughout the day for the simultaneous working of 3–4 saws in each group alternately. The method did not decrease output and considerably reduced the costs of the operation by using one instead of two power units.

[1636]. 32.25 : 07.7 : 82. KHUDYAKOV, P. A. Elektropilÿ na lesozagotovkakh. [**Electric saws in logging operations.**] *Lesnaya Prom.* 1947 (4), (10–12). [Russ.]

Describes, with diagrams, two further methods [cf. preceding abstract] of organizing logging work so that 4–5 electric saws may be run efficiently from a single mobile power unit.

[1637]. 32.25 : 12.25 : 82 : 76.1 : 07.7. CAMPBELL, R. A. **Pine pulpwood production: a study of hand and power methods.** *Tech. Note Stheast. For. Exp. Sta.* No. 66, 1946. pp. 20.

Summarizes the results of a time and cost study in production of Pine pulpwood in the Southern Appalachians, comparing relative costs of producing a unit of wood by hand and by mechanical means. The vital importance of delay time as a factor lowering efficiency is demonstrated. Most delays were due to improper organization of work, which resulted in abnormally long rest periods.

[1638]. 32.25.2 : 07.7. OKRETIC, B. L'abatage mécanique, méthode américaine. [**Mechanical felling: the American method.**] *Bois For. Trop.* No. 2, 1947 (54–8 + plates). [F.]

[1639]. 32.25.4. MILLER, R. H. P., and FOBES, E. W. **Improved harvesting methods. Equipment survey notes. Log bucking yards.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1637–4, 1947. pp. [1] + plate. P.R.

Various details of equipment and lay-out observed in some log bucking yards in the Eastern States of the U.S.A.

[1640]. 32.25.5 : 07.7. KNAPP, G. E. **The woodpeeler.** *Mechaniz. Manual Sth Pulpwood Conserv. Ass.* No. 31, 1947. pp. 2. P.R.

Describes and illustrates 2 small portable bark-removing machines: (1) a fence-post peeler built on a welded iron frame and consisting of a chain barking device which removes the inner and outer bark and, with one operator, will peel 200–350 6½-ft. Pine posts, 3–6 in. in diameter, in an 8-hour day; (2) a pole peeler, also worked on the chain barking system, which moves along the pole under its own power guided by the operator; it takes 4 or 5 trips to remove bark from all sides and 15 minutes (by operating tests) to peel all inner bark off a 45-ft. Pine pole.

[1641]. 32.25.5 : 07.7. **Log debarking.** *Industr. Engng. Chem.* 39 (7), 1947 (74A). P.R.

Describes the working in Newfoundland of a log-barking plant on a barge to be used in small bays. The logs are barked at the rate of 400 cords per day, thus eliminating unnecessary transport of waste material, and on finishing the work the entire barge and plant can move to the next bay.

[1642]. 32.29 (795 : 797) : 07.7 : 32.7. MATSON, E. E., and GRANTHAM, J. B. **Salvage logging in the Douglas-Fir region of Oregon and Washington.** *Bull. Ore. For. Prod. Lab.* No. 1, 1947. pp. 40.

Various surveys of logging waste, methods of salvage logging, types of re-logging equipment and methods of measuring salvaged material are reviewed. In the average logging operation in the Douglas-Fir region of Oregon and Washington, about 27 per cent. of the net bd. ft. volume of the standing timber is being left to rot or burn in the woods. This amounts to 10,000 bd. ft. of sawlog-sized material plus some 10 cords of small material per acre. From the rather meagre data available, it appears that re-logging will be less costly per 1,000 bd. ft. of logs than the original operation. This is due primarily to the fact that salvage stumpage is at present of but nominal value, and that the relogging operation takes advantage of the roads previously constructed. Log grades, however, are lower in the salvage operation.

[1643]. 32.29 : 07.7. **Re-logging machines and methods: a review of special equipment developments.** *Timberman* 48 (11), 1947 (46–8, 72, 74).

32.9. *Transport*

See also *For. Abstr.* 9 (Nos. 1631–2, 1846–9).

[1644]. 32.91.1 : 32.91.2. FALKENBERG, B. Hvordan skal en skogssele være? [**What sort of harness should be used for forestry work?**] *Tidsskr. Skogbr.* 55 (4/5), 1947 (164–6). [Nor.]

The article, which contains an illustration of the harness with the various parts named, points out certain advantages and defects of the harness generally used in forestry work in Norway.

[1645]. 32.91.1 : 46 : 12.26–8 (77) : 22.14.2. ENGLE, L. G. **Skidding damage by tractors and horses in selective logging of northern hardwoods.** *Tech. Notes Lake St. For. Exp. Sta.* No. 277, 1947. p. 1.

Tractor skidding injured more small trees (0–9 in. d.b.h.) than horse skidding, but there was no great difference in the larger diameter classes. Tractor skidding scarified more ground than horse skidding, a matter of importance for the regeneration of such species as Yellow Birch, which need mineral soil in order to establish themselves readily.

[1646]. 32.91.12 : 07.7. (481). IHLEN, N. H. Tømmerdrift i Follebu. [**Logging in Follebu.**] *Tidsskr. Skogbr.* 53 (9/10), 1947 (210–4). [Nor.]

Description with diagrams of the drag sleds used in Follebu.

[1647]. 32.91.12 : 07.7. MILLER, R. H. P., and FOBES, E. W. **Improved harvesting methods. Equipment survey notes. Arch mounted on crawler tractor.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1637–1, 1947. pp. [1] + plate. P.R.

An arch mounted on a caterpillar tractor is used to skid medium or large hardwood logs. The arch is attached to the shaft of the large drum of a double-drum winch at the rear of the tractor and is guyed with a steel cable to the front. The small drum with a light cable is used for bunching logs and the large drum and cable for skidding. The pull from a height raises the front end of the logs and increases the capacity of the tractor.

[1648]. 32.91.12 : 07.7. MILLER, R. H. P., and FOBES, E. W. **Improved harvesting methods. Equipment survey notes. Logging sulkies.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1637–5, 1947. pp. [1] + plate. P.R.

Notes on adaptations of logging sulkies observed in the Southeast and Northeast of the U.S.A.

[1649]. 32.91.12 : 33.02. GODWIN, G. **Problems of mechanized logging.** *J. For.* 45 (8), 1947 (549–54).

Discusses some of the difficulties involved in mechanized pulpwood logging. The chief opportunity lies in the transport of logs from the stump to the landing place. This is at present mainly a matter of man-handling and haulage on horse-drawn sledges, the logs being cut into 4-ft. lengths at stump. Recent experiments have been in the direction of mechanical skidding of tree-length logs to a secondary road, whence they are hauled by tractor-towed wheeled arches to final landings and there cut into 4-ft. lengths by mechanical saws. At present, though mechanical cross-cutting is cheaper in man-hours than hand work at the stump (2·5 cords per man-day compared with 1·5), the mechanical transport of tree-length logs to the landing requires rather more labour than the conventional method. The balance of man-power expenditure on the whole operation is in favour of mechanization but the extra cost of mechanization more than offsets the saving in labour.

[1650]. 32.91.22 : 07.7. MILLER, R. H. P., and FOBES, E. W. **Improved harvesting methods. Equipment survey notes. Hydraulic log cart.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1637–7, 1947. pp. [1] + plate. P.R.

A hydraulic cylinder, mounted on the top of the cart, controls the movement of the chain that raises the load. Pulpwood and sawlogs up to 16 ft. long can be carried practically clear of the ground. Additional information about the cart is obtainable from McIntyre Implement Co., Richmond 9, Va.

[1651]. 32.91.22 : 07.7. Om kälkar för basvägskörning. [**Timber sledges for extraction by road.**] *Skogsägaren* 23 (11), 1947 (205–8). [Sw.]

Good timber sledges are of little avail if insufficient attention has been paid to the organization of work and the provision of proper roads. During studies of the frictional effects of metal runner-shoes differing in

breadth, profile and carbon content, it was found that such factors are of subsidiary importance compared with the upkeep of sledge roads, and the breadth of runners should be determined in the first instance by the degree of wear on the road. Efforts to standardize sledges have as yet had little success, largely because most sledges—and, on the whole, good ones—are produced by small local workshops which turn out their products at competitive rates. The greatest disadvantages of this system are that different makers' fore and rear sledges may not match in track width, method of coupling, etc., and these points should be the first to be standardized.

The commonest faults of timber sledges in Norrland and Dalecarlia are: (1) Track width too narrow (it should be 72·5 cm. from centre to centre of runners). (2) Track area too small in relation to load. (3) Nose of runners too short and bunk situated too far back. (4) Bunk of front sledge pivoted (which causes road abrasion and is dangerous, as the bunk is apt to break loose). (5) Bunk disproportionately wide in relation to track width. (6) Chain, instead of pole coupling of front and rear sledges.

Illustrations are included of some features of Swedish timber sledges.

[1652]. 32.92–4 (470). ORLOV, N. N. Ustroystvo splavnŷkh putey. **[Improvement of waterways for timber-floating.]** *Lesnaya Prom.* 1947 (3), (16–18). [Russ.]

In connexion with plans to increase the total length of floatable waterways in the U.S.S.R. from 105,000 to 220,000 km. by 1950, when the total volume of timber floated is expected to be 61 million cu.m., and in view of the need for river improvement works to this end, existing waterways are classified into 5 groups according to the degree of improvement required: the measures necessary for each group are considered. [Cf. *For. Abstr.* 9 (No. 1409).]

[1653]. 32.92–4 : 11.11. STANKIEWICZ M. J. **Method of forecasting opening dates of streams, rivers and lakes in relation to effective driving.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 949 (B–9a), 1947. pp. 4.

Study of statistical data gathered for the past 4 years and applied to the opening of driving on 7 lakes and rivers, indicates that forecasts can be made with remarkable accuracy. The accumulation of temperature is the prime factor in determining when drives should open: Accumulated temperature consists of degrees of heat registered above 32° F. (freezing point). Conversely, all degrees registered below freezing must be considered a loss rather than an accumulation. For the purposes of this study, maximum and minimum temperatures for each day were alone taken into consideration, and this simple method of establishing accumulative temperature has proved effective. Records must be started on or about March 30th in northern areas. Rivers and lakes vary in becoming free of ice, for reasons of exposure, spring feeding, currents, etc., therefore the required amount of accumulative heat must be established for each particular watershed or lake if dependable prediction of start of drive or tow is expected. Moreover, at least 3 years' records are necessary. Temperature records taken in the immediate vicinity of the drive are best; but records from stations as much as 100 miles away have given good results. When a particular drive opens, the total accumulated heat up to the opening date is permanently recorded, since the rivers or lakes can be expected to open in the coming years under nearly similar circumstances.

The main practical use of this system of forecasting is that it indicates the approximate time when drive crews should be stationed. As the progressive heat chart approaches the 540 F. degrees required to open a certain river (as in the example cited) drive crews are assembled at, say, 400 degrees, since the heat record shows a daily gain of about 20 degrees, giving 7 days' warning of the river becoming drivable.

[1654]. 32.92–4 (470) : 32.22 : 32.24 : 32.25.5. SHUL'TS, G. Bor'ba s utopom pri molevom splave. **[Reduction of sinking in loose-floated timber.]** *Lesnaya Prom.* 1947 (3), (19–20). [Russ.]

Reports on studies by the Central Timber-floating Research Institute and the Siberian Forest Research Institute. The former studied floating losses over a distance of 300 km. on the Pola R., Novgorod Province, the timber—which was in the water for an average of 72 days—consisting of 31·5 per cent. Scots Pine and Norway Spruce sawlogs, 16·4 per cent. small-diameter logs of the same species, 11·5 per cent.

Birch, Aspen and Alder sawlogs and 40·6 per cent. fuelwood of the latter 3 species.

Eighty per cent. (by volume) of the sinking occurred at booms, where much timber jams under water and, in addition to its greater moisture content, collects suspended matter which adds to its weight. In Birch felled in March–April and floated the same spring, loss by sinking in 120 days amounted to 75 per cent., whereas only 12 per cent. was lost in material kept until the following spring before floating. Experiments with '*kislaya rubka*' (felling in summer or early autumn and leaving the crowns to transpire for a few days before trimming) showed that the first 3 days of transpiration could reduce specific gravity of the wood by 14 per cent., and this type of felling, which gave a sinkage loss of only 2 per cent. [cf. *For. Abstr.* 9 (No. 1498)] (with floating in the succeeding spring), is recommended for deciduous species. The greatest rate of sinking occurred in the first 10 days of floating in material felled by the ordinary method.

Wood of deciduous species developed considerable brown stain if felled in spring or early summer and was fit only for fuelwood; sawtimber of these species should be cut in August–September.

Unbarked small timber of Pine and Spruce was 14 times as liable to sinking as similar material barked and dried before floating. Fuelwood with decay gave 3 times as much sinking as undecayed: round fuelwood of deciduous species with decay gave 9 times as much sinking as that without decay, but if cleft into half- or quarter-logs, only 2–4 times as much.

The data recorded by the Siberian Forest Research Institute indicated that sinking of Larch was reduced by barking timber felled by the normal method and still more so if trees were girdled before felling. Girdling should be completed not later than a month before the end of the growing season; girdled trees must be felled in the same season, but not until the foliage yellows and begins to fall. Sinking of completely barked logs was less than 1 per cent., and of those from girdled trees as little as 0·27 per cent.

Sinking of unbarked Larch varied between 2 and 6·3 per cent. according to the period of floating and the suitability of the river (presence of improvement works, etc.) for floating.

Recommendations based on the findings are that: (1) With hardwoods, only timber not liable to brown stain should be felled in spring and early summer; logging of other species should take place in summer and autumn. (2) Small timber should be barked some months before floating operations. (3) Timber with decay should not be accepted for floating; fuelwood should be halved or quartered. (4) Larch logs should either be completely barked or the trees should be girdled before felling. (5) Floating operations should be speeded up by better organization and river improvements.

[1655]. 32.92–4 : 07.7. KOZHANOV, D. I. Novaya splotochnaya mashina Unzhlesovets-3. [**A new bundling plant for rafted timber —the 'Unzhlesovets-3'.**] *Lesnaya Prom.* 1947 (3), (20–1). [Russ.]

Description of a floating plant for bundling logs, constructed by the Volga-Kama branch of the Central Timber-floating Research Institute, and designed for small floating depots with a seasonal capacity of up to 70,000 cu.m. The plant is illustrated diagrammatically and notes are included on the method of working.

[1656]. 32.94 (213). TERVER, P. Le commerce des bois tropicaux: (3) Le transport maritime des bois. [**The tropical timber trade: (3) Transport of timber by sea.**] *Bois For. Trop.* No. 2, 1947 (79–85). [F.]

Mainly an account of freights, dues, insurance, and the shipping companies involved in transporting timber from the French colonies in tropical Africa.

[1657]. 32.96. MIRONOV, T. Pogruzka na verkhnikh skladakh. [**Loading at forest timber depots.**] *Lesnaya Prom.* 1947 (3), (15). [Russ.]

Describes and illustrates a method of loading tramway wagons in which corduroy ramps are built on either side of the tramway and plankways are laid between ramps and wagon, so that a load of logs can be driven on to the wagon, unloaded there, and the emptied vehicle driven off again on the opposite side.

In order to leave room for the vehicle, logs are piled high at both ends of the tramway wagon until the last vehicle has passed through, when they are rolled back into the empty space in the centre. The plankways are then

removed while a fresh wagon is brought into position.

[1658]. 32.96 : 07.7. KISHCHENKO, T. I. Pogruzka konnym derrikom. **[Loading with a horse derrick.]** *Lesnaya Prom.* 1947 (2), (6–7). [Russ.]

Description, with diagrams, of a simple horse derrick made from deadwood (strong and light) of Norway Spruce or Scots Pine, for loading timber on to transport at forest timber depots; also a brief account of the special harness used and the method of working. With 3 workers and 1 horse the derrick can handle about 120 cu.m. per [? 8-hour] shift.

[1659]. 32.96 : 07.7 : 33.02. KNAPP, G. E. **Chesapeake corporation loads pulpwood by crane.** *Mechaniz. Manual Sth. Pulpwood Conserv. Ass.* No. 33, 1947. pp. 2. P.R.

Describes the mechanized transfer of pulpwood from concentration yard to barge on inland waterways. At the concentration yard a ¾-yard Northwest crane with pulpwood grapple loads the truck. At the landing a diesel-powered stiff-leg derrick transfers the wood from truck to barge. Approximately 250 cords of wood are handled per 8-hr. day.

[1660]. 32.96 : 07.7. MILLER, R. H. P., and FOBES, E. W. **Improved harvesting methods. Equipment survey notes. End loading trucks.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1637–2, 1947. pp. [1] + plate. P.R.

Self-loading trucks equipped for end loading have steel frames immediately behind the cab and extending well above it. This supports the cable which is pulled up by a winch. Logs are hauled up to the level of the truck over two skids at the rear.

[1661]. 32.96 : 07.7 : 32.91.22. MILLER, R. H. P., and FOBES, E. W. **Improved harvesting methods. Equipment survey notes. Self-loading semi-trailers.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1637–3, 1947. pp. [1] + plate. P.R.

The truck and trailer form a standard unit built to self-load and carry the trailer on the return trip. The unique feature is a mobile chute for loading logs on to the trailer.

33. CONVERSION AND PRESERVATION OF WOOD

See also *For. Abstr.* 9 (No. 1795).

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

[1662]. 33.1 : 07.7. HUDSON, H. R. **Woodworking machinery.** George Newnes Ltd., Southampton Street, Strand, London. 1946. pp. 134. Price 10*s.* 6*d.* P.R.

An illustrated work with chapters on the rising-top sawbench, crosscut saws, surface planers, mortising machines, vertical spindle moulders, band sawing machines, planing and thicknessing machines, sawbenches, tenoning machines and the universal woodworker.

[1663]. 33.1 : 07.7 : 33.15.3. **Cutting hard materials: tungsten carbide tipped circular saws and cutters.** *Timb. Tr. J.* 182 (3703), 1947 (1038–9).

The Sagar Organization of Halifax (Yorks.) has for some time been carrying out experiments in the cutting of hard and abrasive materials such as high-density plywoods, compressed and laminated plastic sheets, and improved woods. It has now produced a range of cutting tools, including circular saws, having tungsten-carbide tips at the cutting points. The life of these tools on very difficult materials is 10–40 times that of ordinary tools. The tungsten-carbide tips are brazed to the saw body, and in most cases the teeth are only one gauge thicker than the equivalent normal hollow-ground circular saw. A special grinding machine is also described. [Cf. *For. Abstr.* 9 (No. 1706).]

Use of Wastes

See *For. Abstr.* 9 (Nos. 1716–17, 1735, 1756, 1764).

33.12. Joinery, Turnery. Bending of Wood

See also *For. Abstr.* 9 (No. 1611).

[1664]. 33.12 : 07.7. LISTER, S. **Planes and planing.** Lomax, Erskine & Co. Ltd., Aldwych House, London. 1947. pp. 93. Price 5*s.* P.R.

[1665]. 33.12 : 07.7. **A portable electric plane.** *Timber News* 55 (2098), 1947 (292).

The G. and W. Lowe portable electric plane with accessories, comprising a rabbeting shoe, moulding cutters and a splitting saw $4\frac{1}{2}$ in. in diameter, all of which fit on the cutter spindle.

[1666]. 33.12 : 07.7. KASHTALYAN, A. F. Povyshenie proizvoditel'nosti shlifoval'nykh stankov. [**Increasing the efficiency of sanding machines.**] *Lesnaya Prom.* 1947 (1), (12–14). [Russ.]

In machine sanding, pressure is the chief factor affecting rate of production and it is common practice for the operator to judge by ear, a method which may give unsatisfactory results.

Kashtalyan's experiments indicate that for practical purposes, sanding pressure and power consumption can be taken as directly proportional, so that the former can be assessed and controlled by readings from a wattmeter in the motor circuit. Under otherwise similar conditions, it was found that the grain of the abrasive and the species of timber had little effect on power consumption. With drum sanders, width of the article processed was a significant variable. For a given machine it is possible to compile a table from which the operator can read the appropriate power consumption for articles of various widths. An example of such a table is given.

Laboratory trials indicated that the optimum mean drum pressure is 0·40 kg./sq. cm. The breadth of the contact between wood and abrasive is calculated in cm. as $\sqrt{4\,Dh}$, where D = diam. of drum and h = the 'give' of the abrasive (conventionally measured with the drum at rest) both in cm. From this it is easy to calculate total pressure (p) on the object processed and knowing the coefficient of adhesion (K) between abrasive and wood (determined by the author as 0·39, with very little variation) a 'cutting force' (P, in kg.) is calculated as the product of $p \times K$. Effective power consumption (N, in KW.) is given by the equation $N = Pn\ D\ 0{\cdot}5134$, where n = drum revs./min. and D = diam. of drum in m. Total power consumption is obtained as the sum of power used when drum and motor are idling, plus electrical loading of the motor, plus effective power consumption.

[1667]. 33.12 (431–5) : 33.4 : 33.15.1. STEVENS, W. C., RENN, H. A., POLLARD, G. J. T., and HAINS, L. G. **German wood bending industry.** *Final Rep. Brit. Int. Obj. Sub-comm.* No. 645, Item No. 22, 1946. pp. 17. P.R.

Firms visited covered hand and machine bending, laminated bending, moulding of plywood, and the manufacture of hinges of veneer assemblies; the presses and dies used in the last showed considerable engineering skill but it is doubtful whether such hinges could normally compete in cost or quality with metal ones. Methods and machinery resemble those used in the U.K.

[1668]. 33.12 : 33.3 : 31.27. HOWES, D. E. **Chemical and mechanical aids in wood bending.** *Rep. 6th Vt. Wood Prod. Conf.* 1946 (24–36). P.R.

Reviews experiments made on Ash wood samples to determine the effects on bending quality of various softening methods including steaming, boiling in water, and soaking and vacuum impregnation with urea. The samples were tested for compression, tension and shear strength. Results indicate that urea has no marked advantage over other softening agents.

[1669]. 33.12 : 33.3. HAMILL, R. E. **Urea treatment of wood.** *U.S. Patent* No. 2,414,808, Jan. 28, 1947. *Chem. Abstr.* 41, 1947 (2280). P.R.

The flexibility and plasticity of wood are increased by heating strips with a solution containing at least 4 oz. urea per gallon of water for 30 minutes to 1 hour at a pressure of 50 to 135 lb./sq. in. The grain structure is not changed and the treated material can be bent while hot.

33.13. Shingles

[1670]. 33.13 (664). PELLY, R. S. **Shingles in Sierra Leone.** *Fm. & For.* 8 (1), 1947 (18–19).

The production and use of roofing shingles has recently been revived in the form of machine-sawn shingles. At present only *Tarrietia utilis* and *Terminalia ivorensis* are recognized as reliable shingle-woods, but other species could probably be used if given preservative treatment. Details are given of costs of manufacturing and laying shingles.

33.14. Match Manufacture

See *For. Abstr.* 9 (No. 1586).

33.15. Manufacture and Use of Veneers and Laminated Wood. Improved Woods. Laminated Materials other than Wood. Glues and Gluing

[1671]. 33.15 (431–5). WANGAARD, F. F., and TIGELAAR, J. H. **The manufacture of plywood and related products in Western Germany.** *Fiat Final Rep. Brit. Intell. Obj. Sub-comm.* No. 202, 1945. pp. 66 + [12] + figs. P.R.

New developments in furniture plywood, modified wood, moulded and metal-faced plywoods or in urea, melamine and phenolic glues are few. Aircraft plywood compares favourably with the American product. In the production of hot-pressed laminated veneer for gunstocks and aircraft structures, liquid phenolic resins were spread on veneer, and subsequently dried at 158° F. to 230° F. to the moisture desired for pressing. 'Polystal', a resin adhesive, is a mixture of Desmaphen and Desmadur (poly-isocynates) in an ethyl-acetate solution. It is said to set at 32° F. in a comparatively short time, to be neutral to chemical reaction and very tough. Reports of research work were not particularly significant. Twenty-five plants were visited. An appendix gives representative aircraft plywood specifications.

[1672]. 33.15 : 31.27 : 33.8. HOFF, N. J., and MAUTNER, S. E. **Bending and buckling of sandwich type beams.** Skydyne Inc., Port Jervis, New York. 1946. pp. 25 + gphs. P.R.

From the essential parts of the strain energy stored in the faces and core and from the potential of the transverse and axial loads, the differential equations of bending a sandwich-type beam were derived by means of the variational principle. Integration of these differential equations yielded simple formulas for the deflection of a cantilever and for the buckling load of a column. Beam and column tests carried out on 64 specimens gave results in reasonable agreement with the theory. [Among the materials tested was Balsa wood for the cores.] *Authors' summary.*

[1673]. 33.15 : 31.27 : 31.4. HEEBINK, B. G., KOMMERS, W. J., and KUNZWEILER, J. J. **Durability of low-density core materials and sandwich panels of the aircraft type as determined by laboratory tests and exposure to the weather. Part 1.** *Rep. U.S. For. Prod. Res. Lab., Madison* No. 1573, 1947. pp. 25 + 15 tbls. + 14 plates. P.R.

Discusses the effects of exposure to water, high humidity, high temperature and alternations of high and low temperatures, fire, aircraft liquids, outdoor weathering and conditions favouring decay, on 3 core materials, viz. Balsa, cellular cellulose acetate, and cellular hard rubber; and on the combinations of these 3 with 3 face materials, viz. aluminium, resin-impregnated glass cloth, and plywood. The results are tabulated, giving data of ultimate strength in compression and tension, stress at the proportional limit, modulus of elasticity and rigidity, specific gravity and changes in weight and dimension.

33.15.1. *Manufacture of Veneers and Laminated Wood*

See also *For. Abstr.* 9 (Nos. 1586, 1667, 1738).

[1674]. 33.15.1 (431–5). BARNES, J. S. **German veneer industry.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1268, Items No. 22 and 31, 1946. pp. 11 + 2 plates. P.R.

Nine factories, all more or less damaged, were visited. Operations and plant resembled those in U.K. Air drying is largely used though some types of wood are mechanically dried.

[1675]. 33.15.1 : 02.1 : 33.15.5 : 12.25–8 (81). BROTERO, F. A. Dados para a indústria de contraplacados. **[Information about the plywood industry.]** *Bol. Inst. Pesqu. tech. S. Paulo* No. 33, 1946. pp. 53. [Port.]

A general handbook of plywood production. Suitable Brazilian species are listed, the most important being *Cedrela* spp. and *Araucaria angustifolia.*

[1676]. 33.15.1 : 07.7 (81). Industrias Madeirit Ltda. apresentam a nova prensa quente de pratos múltiplos para madeira compensada. **[Industrias Madeirit Ltda. present a new multiple hot press for plywood.]** *Brasil madeireiro* 2 (19), 1946 (18–19). [Port.]

An illustrated description of a multiple plywood press patented by Industrias Madeirit

Ltda., São Paulo. The platens, of which there are several, are hollow and are injected with hot water which is subjected to the same hydraulic pressure as the cylinder which operates the press. Since the same pressure is exerted both within and without the platens, they can be of much lighter construction—without any danger of buckling—than those usually required in a hot press.

[1677]. 33.15.1 : 07.7. HEEBINK, B. G. **Fluid-pressure moulding of plywood.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1624, 1946. pp. 19 + ii + tbls. + figs. P.R.

Equipment, materials (including glues) and technique for fluid-pressure moulding. Supersedes Reports Nos. 1347 and *R*1431 [see *For. Abstr.* 7 (No. 289)] of which it is an expanded version.

[1678]. 33.15.1. MCCLARY, H. W. (to Washington Veneer Co.). **Plywood products.** *U.S. Patent* No. 2,418,233, Apr. 1, 1947. *Chem. Abstr.* 41, 1947 (4922). P.R.

A means of avoiding checking of freshly hot-pressed panels of plywood and resin-impregnated paper by stacking in piles with wet 'caul' sheets, of paper, cloth, and fibre or preferably plywood, against the faces of the plywood; after about 12 hours the panels have a temperature of 150–180° F. and can be treated with air from a blower in a ventilated stack for about 20 minutes.

[1679]. 33.15.1 : 33.8. ILCH, T. E. (to U.S. Plywood Corp.). **Plywood tubing.** *U.S. Patent* No. 2,411,542, Nov. 26, 1946. *Mod. Plastics* 24 (7), 1947 (168). P.R.

An integral moulded seamless tube is formed by introducing layers of sheets of fibrous material coated with thermo-sensitive adhesive into a rigid cylindrical casing until the layers are built up in tubular form against its inner surface. A tubular membrane is then introduced to distend the layers by heat and pressure, sufficient to press them against the casing, thus bonding the sheets together and moulding them to its shape.

33.15.2. *Use of Plywood and Other Laminated Wood*

See also *For. Abstr.* 9 (Nos. 1783–7, 1836–8).

[1680]. 33.15.2 : 12.26–8 : 31.22.2. VINTILA, E. Contragerea şi umflarea placajelor de fag încleiate cu clei pe bază de răşini sintetice. **[Shrinkage and swelling of Beech plywood glued with synthetic resin glues.]** *Rev. Pădurilor* 57 (7/9), 1945 (145–54). [Rum.f.]

The author gives the result of studies in the shrinkage of plywood from saturation point to oven-dry condition (total shrinkage). The material used consisted of 12 kinds of plywood (1·2–5·2 mm.) of 3 or 5 plies glued with Tego or Kaurit. The following results were obtained:—(1) Shrinkage in the direction of thickness varied between 6·9 and 9·6 per cent. (2) Shrinkage parallel to the surface of the plies was uniform in all directions and varied between 0·4 and 0·8 per cent. (3) Volumetric shrinkage varied between 8·2 and 11·0 per cent.

These results compare very favourably with those for solid Beech. Shrinkage coefficients for 1-per-cent. moisture content are given; also a practical example of the dimensional change of plywood caused by a 5-per-cent. variation in moisture content.

[1681]. 33.15.2 : 31.27. GREEN, A. E., and HEARMON, R. F. S. **The buckling of flat rectangular plywood plates.** *Phil. Mag.* 36 (261), 1945 (659–88). O.R.S.

General equations are established for the buckling of a thin rectangular plate of any aeolotropic material under the action of stresses along its edges. The application of the analysis to plywood plates, cut at any angle to the grain, is discussed by deriving approximate formulae which are fairly simple to use for calculations. The main numerical results are given for plates of Mahogany 5-ply, with all the plies of equal thickness, and the edges either all simply supported or all clamped. The influence of plywood structure, of wood species, and of other edge conditions is also briefly discussed.

[1682]. 33.15.2 : 31.27. SMITH, C. B., RINGELSTETTER, L. A., and NORRIS, C. B. **Buckling of stiffened flat plywood plates in compression. A single stiffener parallel to stress.** *Rep. U.S. For. Prod. Lab., Madison* No. 1553–B, 1947. pp. 28 + tbls. + figs. P.R.

A mathematical analysis of the critical stress of a plywood plate in edge compression stiffened by means of a single stiffener glued to the plate in a direction parallel to the stress. The analysis yielded an approximate formula for the minimum required in the stiffener to keep

it straight when the panel buckles. [Cf. *For. Abstr.* 9 (No. 1013).]

[1683]. 33.15.2 : 31.27. KUENZI, E. W. **Stability of a few curved panels subjected to shear.** *Rep. U.S. For. Prod. Lab., Madison* No. 1571, 1947. pp. 13 + tbl. + figs. P.R.

Tests on plywood plates indicated that the buckling stress of a curved plate is approximately equal to the sum of the buckling stress of a complete cylinder subjected to torsion and the buckling stress of a flat plate of the same size as the curved plate subjected to shear. A test on a plate of sandwich-type construction indicated that the theory for plywood can be extended to sandwich constructions. Curves are given showing the theoretical buckling coefficients for the latter.

[1684]. 33.15.2 : 31.27 : 12.25. MARKWARDT, L. J., and FREAS, A. D. **Approximate methods of calculating the strength of plywood.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1630, 1946. pp. 1 + tbls. P.R.

Gives tables, sufficiently accurate for most structural design purposes where buckling of the plywood does not occur, for calculating the strength and stiffness of plywood, with suggested working stresses for Douglas Fir plywood.

[1685]. 33.15.2 : 31.8. KNIGHT, R. A. G. **The surface-checking of plywood in service.** *Wood* 10 (12), 1947 (285–7).

In 1942, studies were initiated at the Forest Products Research Laboratory, Prince's Risborough, on the influence of surface-veneer thickness and the geometry of the board on surface checking during exposure of Beech plywood to various conditions. The boards were taken down in January 1947, restored to the original moisture content of 12 per cent., and examined for checking. It was found that: (1) The type of surface checking depends entirely on the thickness of the face veneers and is independent of the total thickness of the board and of the number and gauge of the veneers forming the core. (2) Face veneer 0·063 in. thick or less, does not check under normal interior conditions. (3) Under exposure to weather, checking occurred with 0·063-, 0·027- and 0·02-in. faces to an extent diminishing with the thickness. (4) Checking occurred with the 0·125-in. faces under both interior and exterior exposure, being much more severe for the latter.

In a second experiment, the influence of species as well as veneer thickness on surface checking was investigated. The following general facts emerged: (1) None of the boards kept indoors had checked at all. (2) All the panels exposed to weather had checked to some extent, and in any one species those made with the thicker faces had checked the more. (3) The panels had weathered to a uniform grey, the species in this respect being indistinguishable. The species tested are classified in three groups according to the amount of checking, as follows: Group I (most checking) *Larix decidua*, *Pinus sylvestris*, *Fagus sylvatica*; Group II, *Pachylobus barteri*, *Betula lutea*, *Cistanthera papaverifera*; Group III (least checking) *Distemonanthus benthamianus*, *Lannea acidissima*, *Terminalia ivorensis*, *Triplochiton scleroxylon*.

[1686]. 33.15.2 : 33.4 : 12.26–8. STERN, E. G. **A new type of Oak flooring. Its prefabrication and mass production.** *Nat. Hardwood Mag.* May, 1947. pp. 4. P.R.

A continuous three-ply cross-laminated Oak flooring with tongued and grooved edges is manufactured by cross-laminating three layers of 3-in.-wide Oak slats, of 0·27 in. thickness and random lengths, into endless boards. The outer layers can be of selected material and the core of low-grade material. Tests at the Virginia Polytechnic Institute laboratory indicate that such flooring can resist internal stresses due to extreme exposure. Phenol-resorcinol resin glue proved more satisfactory than urea-formaldehyde resin glue in such conditions. Mass production is carried out on a specially designed continuous press.

33.15.3. *Improved Woods*

See also *For. Abstr.* 9 (Nos. 1663, 1739, 1784).

[1687]. 33.15.3. DALTON, L. K., FITZGERALD, J. S., and HATT, H. G. **Synthetic resins for the manufacture of improved wood.** Division of Industrial Chemistry, Council for Scientific and Industrial Research, Melbourne. Serial No. 60, 1946. pp. 23 + 5 gphs. P.R.

Reviews literature relating to the composition of phenol-formaldehyde resins used for improved wood, discusses their preparation, and the course of their reactions during preparation and ageing.

[1688]. 33.15.3. **Chemical improvement of wood.** *Timber News* 55 (2098), 1947 (289–91).

Describes the impregnation of wood in a pressure chamber with 'Arboneeld' dimethylolurea and urea, the two chemicals reacting to form an insoluble resin in the pores and fibres of the wood. The result of the reaction is an increase in weight, hardness and compressive strength perpendicular to the grain, along with increased brittleness. Moisture resistance and machinability are also increased. Tests of the effect on attacking fungi and pests are being continued. At temperatures of 240° F. and higher the insolubilized resin begins to melt and the wood may be compressed, the resin rapidly setting and holding the wood in a compressed state. The compressed wood is very hard and dense but not completely resistant to water.

[1689]. 33.15.3 (431–5) : 33.8. SEBORG, R. M., and FLEISCHER, H. O. **Modified and improved wood in western Germany.** *FIAT Final Rep. Brit. Intell. Obj. Sub-comm.* No. 394, 1945. pp. 47. P.R.

Though German techniques for manufacturing improved woods are already well known, significant information was gained on the wide extent of their use in industry. Compressed wood (*Pressholz*) has been made from both laminated and solid wood, chiefly from Beech. Compressed solid wood is used mainly in the textile industry for shuttles and picker sticks. Laminated improved-wood products are generally the secondary products of veneer and plywood mills, the bulk being made into forming moulds, but also propellor blanks, gears and other articles. Resin-bonded compressed veneer made fine bearing retainers for use in extremely-high-speed ball bearings. Plans are afoot to use compressed laminated panels as external panelling in pre-fabricated houses.

Research to improve wood properties by other chemical and physical means was found to be very limited.

33.15.4. *Laminated Materials other than Wood*

[1690]. 33.15.4 : 33.15.1. TITARD, P. Un matériau moderne Plymax. [**A modern material: Plymax.**] *Rev. Bois Appl.* 2 (6), 1947 (26–7). P.R.

The material consists of ordinary plywood with one or both faces, or in certain cases the core, consisting of a metal leaf; it is strong, light, a poor conductor of heat and sound, and resistant to fire, rot, and insect attack.

[1691]. 33.15.4 : 33.15.5 : 33.15.1. PERRY, T. D. **Wood-to-metal adhesives.** *Mech. Engng.* 68 (12), 1946 (1035–40). D.S.I.R.

Discusses the development of wood-to-metal laminates and their uses, including sandwich constructions with low-density core as used in aircraft, fireproof partitions having a sheet-metal core and natural wood finish, cigarette-proof desk tops in which a thin metal layer under the face veneer dissipates and distributes the heat, preventing burning, and a metal-lined chest for powder and explosives. Common methods of wood-to-metal lamination are: (1) the use of a metal-to-metal adhesive on the metal side of the joint and a compatible wood adhesive on the wood side, bonding and curing being completed in a single operation by the application of heat and pressure; (2) the preliminary application and curing of adhesive to the metal, followed by bonding the metal layer to the wood with room-setting adhesives; (3) the use of a metal-to-wood adhesive in sheet form which is interleaved between the 2 layers and cured by heat. (This product is very durable, and in shear strength approaches closely to wood itself); (4) non-plywood applications, as when solid wood and metal are bonded together, superseding rivetting, e.g. in tool-handles; the usual method of application being (2) above. All these methods have their uses in different circumstances.

[1692]. 33.15.4 : 35.15.5 : 33.8. EICKNER, H. W. **Durability of glued wood-to-metal joints. First progress report.** *Rep. U.S. For. Prod. Lab., Madison* No. 1570, 1947. pp. 14 + tbls + figs. P.R.

Describes tests on the comparative durability of wood-to-metal joints, using plywood and Birch-Walnut veneers, made with 6 commercial adhesives and using 6 different gluing processes to determine their suitability in aircraft construction. Exposure conditions were selected to measure resistance of painted and unpainted aluminium-to-wood and steel-to-wood joints to water, high humidities, high and low temperatures, aircraft fluids and weather. The results, which are tabulated,

were usually so indistinguishable for painted and unpainted specimens that they could be considered together.

33.15.5. *Glues and Gluing*

See also *For. Abstr.* 9 (No. 1784).

[1693]. 33.15.5. BRUYNE, N. A. DE. **Manufacture and use of some German synthetic adhesives and raw materials.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 456, Item No. 22, 1946. pp. 62 + fig. P.R.

Report on an investigation of the methods of manufacture of some German synthetic adhesives of interest for aircraft construction, as well as of some of the raw materials and plant employed. The items covered are: the cold-setting phenolic glue P600, Pressal melamine adhesives, resorcinol, Polystal, formalin, Kaurit powder and foam glues; Iporka synthetic-resin solution which in combination with the Iporka foaming agent produces the insulating material known as Iporka; urea, and Imprenal, a water-soluble synthetic resin.

[1694]. 33.15.5. OLSON, W. Z., and BRUCE, H. D. **Polyvinyl-resin emulsion wood-working glues: a study of some of their properties.** *Sth. Lumberm.* 175 (2196), 1947 (59–66).

Describes the polyvinyl-resin emulsion group of glues and discusses and tabulates the results of tests on 11 commercial examples. Dry joint strength was tested in Birch plywood and within Hard Maple blocks and panels; it varied widely with the different glues. None of the glues examined showed a water resistance appreciably greater than that of unfortified animal glue. One glue showed rapid development of strength in lap joints, whereas in other tests with plywood panels 2 of the 11 glues tested did not set sufficiently to allow release of pressure in 30 minutes. Tests of one glue showed it to be tolerant of 2–11 per cent. moisture in Birch plywood at time of gluing; probably, however, the rate of setting is influenced by the moisture content of the wood. Plastic flow of the resin in the joint may under some conditions allow the joint to slip and open; the glues vary greatly, however, in this respect, and none appeared so resistant to sustained loading at room temperatures as did an animal and a casein glue used for purposes of comparison.

[1695]. 33.15.5 : 33.15.1. BLYLER, L. L., CLOUGH, J. W., HAWLEY, C. W., and PITMAN, E. C. (to du Pont de Nemours & Co.). **Polyvinyl resin adhesive composition, plywood, and method of making plywood.** *U.S. Patent* No. 2,419,880, Apr. 29, 1947. *Chem. Abstr.* 41, 1947 (4677). P.R.

An adhesive for joining cellulosic surfaces is prepared from the reaction product of a linear polymeric polycarboxylic acid and 37–70 per cent. hydrolysed polyvinyl acetate. This adhesive, when used to laminate plywood, yields a product having a shear strength of 547 lb./sq. in. with 90 per cent. wood failure.

[1696]. 33.15.5. : 31.22.1. ERCOLANI, F. **Controlling the moisture content of synthetic resin bond.** *Timber News* 55 (2099), 1947 (317–8).

Discusses the poor adhesion of veneers, found to be due to the moisture in the material being raised above the boiling point of water when panels were pressed at about 100 lb./sq. in. and 220° F. for 9 minutes; when the water vaporized, pressure was relieved, the resulting steam loosening the veneers. Experiments to reduce the moisture content were made. In the ply it was found to be only 10–12 per cent. In the usual bond formula (resin bond 10 lb. = 7 lb. solids and 3 lb. fluid + hardener 1 lb. = 1 lb. fluid) the ratio of fluid to solid is 4 : 7; but the use of filler (rye or wood flour, or china clay) to prevent the resin bond from penetrating the veneer may increase this ratio to as much as 15 : 17 (depending on the manufacturer's formula). A recommended formula using the minimum of filler necessary to prevent penetration (resin bond 10 lb., hardener 1 lb., filler 2½ lb., water 1 lb.) reduces the ratio to 5 : 9. Reducing the thickness of the glue joint further reduces the moisture content.

The advantages in economy of resin-bond consumption and a more even and thinner spread of foaming resin bonds are also discussed.

[1697]. 33.15.5 : 31.21.4 : 12.26–8. DUNLAP, M. E., and BELL, E. R. **Temperature distribution in White Oak laminated timbers heated in a high-frequency electric field.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1638, 1947. pp. 8 + figs. P.R.

In tests of the efficiency of high-frequency dielectric heating for laminating commercial White Oak ship timbers, specimens were

heated both with and without glue to study the temperatures obtaining in the glue-line areas. Uniformity of temperature was found to vary with the density, moisture content and arrangement of the laminations and with the effective thermal insulation of the material; variations were greater when the electric field was parallel than when it was perpendicular to the glue line. An effective method for heating the sides of timbers by interposing wet blotters between the timber and the insulating board was developed.

[1698]. 33.15.5 : 33.4 : 33.15.2. BELL, E. R., and DUNLAP, M. E. **Gluing of plywood to concealed framing members with high-frequency stray field heating.** *Prefab. Homes* 8 (2), 1947 (15–17, 28–9). [U.S. Forest Products Laboratory, Madison.] L.S.

Satisfactory joints between plywood panels and framing members, used in prefabricated buildings, were obtained by heating the glue line for 1 minute by means of a high-frequency stray field. Casein, urea, resorcinol and phenol resin glues were used in experiments at the Forest Products Laboratory, Madison, with $\frac{1}{4}$-, $\frac{3}{8}$- and $\frac{5}{8}$-in. Douglas Fir plywood and $\frac{3}{4}$- and $1\frac{5}{8}$-in. Douglas Fir framing members. Voltage used must be low enough to avoid burns, which are apt to occur in open core joints of plywood. Safe operating voltages were respectively 7,500, 11,500 and 12,500 volts for the $\frac{1}{4}$-, $\frac{3}{8}$- and $\frac{5}{8}$-in. plywood with $1\frac{5}{8}$-in. framing members, and 7,500, 7,500 and 11,500 volts for $\frac{1}{4}$-, $\frac{3}{8}$- and $\frac{5}{8}$-in. plywood with $\frac{3}{4}$-in. framing members. A heavier spread was necessary with phenol resin than with the other glues. Joint strengths obtained were greater than those of the plywood itself.

[1699]. 33.15.5 : 31.21.4. MOON, C. L., and WAKEFIELD, W. E. **Project 263. Progress report No. 1. Infra-red drying of glue joints. Development of basic data on penetration and spread of infra-red heating and its utilization in the curing of glues.** Forest Products Laboratories, Dominion Forest Service, Ottawa. 1946. pp. 7 + 6 plates + 54 dgms. P.R.

Tests were conducted to study the effects of commercial infra-red heating lamps on wood both at the surface and at depths up to 3 in. Experiments were made on dry Douglas Fir timber (6 × 9 in.) for periods up to 5 hours. Temperatures were measured at various depths and at stated intervals both along the centre line of the centre lamp and on different offsets from the centre line. The results are plotted. With a 12-in. gap between lamp and wood and no screen, surface temperatures varying from 155° F. with 1 lamp to 225° F. with a 3-lamp concentration were achieved. Temperatures below the surface decreased rapidly and only began to rise again at depths of more than $\frac{3}{4}$ in. from the surface after a distinct time lag. This suggests that internal heating at such depths is achieved by conduction from the surface rather than by the penetrating effects of the infra-red radiation. *From authors' summary.*

[1700]. 33.15.5. KITAZAWA, G. **A study of adhesion in the glue lines of twenty-two woods of the United States.** *Tech. Publ. N.Y. St. Coll. For.* No. 66, 1946. pp. 55.

The value of adhesion depends upon the physical and chemical composition of the surfaces in contact. Experiments were made with 22 hardwoods and softwoods of the U.S.A. to determine whether differences in gluing qualities are due to their anatomical structure. Two room-temperature-setting resin glues were used. After gluing, the specimens were examined microscopically in order to find the percentage of defective glue line, range of glue thickness and depths of glue penetration into vessels, rays, resin canals and contiguous fibres. Penetration occurred mainly through the cut ends of cells, the depths varying with the angle of the grain. The amount of pore surface along the glue line in linear measurement, the amount of contact between glue and wood and amount of deformation in the wood at the external glue line were also noted. Shear-strength values were obtained for the glued and unglued woods and the values for the glued wood were reduced to ratios, expressed as a decimal fraction of the test values for solid wood in shear. A visual study was also made of the sheared surfaces. Data from the experiments are given in full and their use in determining glue efficiency is discussed.

[1701]. 33.15.5. GHELMEZIU, N. Incercări privitoare la influența formei pieselor de probă asupra resistenței încleieturilor la placaje din șapte foi. **[The influence of the type of test specimens in testing glue strength in plywood of 7 plies.]** *Rev. Pădurilor* 57 (7/9), 1945 (155–62). [Rum.f.]

Tests of glue strength made on 5 different types of test specimen of 7-ply plywood led to the following conclusions. Results differ according to the type of test specimen used. Glue strength may vary between plies in the same specimen. In testing 7-ply it is advisable to use two different types of specimen giving ruptures in different glue lines, and take the mean of the results obtained from the two types.

[1702]. 33.15.5. GABRIEL, A. E. **A comparison of the durability of 23 urea resins in glue joints exposed to nearly saturated air at 75° C. (167° F.).** *Rep. U.S. For. Prod. Lab., Madison* No. 1355, 1947. pp. 4 + tbls. + figs. P.R.

Birch plywood specimens glued with 23 urea-formaldehyde glues were exposed in glass jars to nearly saturated air at 75° C. for periods up to 96 hours, and the joint strengths periodically tested. Results are tabulated. The rate of deterioration varied widely for different glues.

[1703]. 33.15.5. GHELMEZIU, N. Incercarea rezistenței incleieturilor la placaje: incercări comparative cu piese de probă umezite în apă la temperatura camerei sau prin fierbere in apă. [**Tests of strength of plywood glues: comparative tests with specimens soaked in water at room temperature and boiled in water.**] *Rev. Pădurilor* 57 (1/3), 1945 (1–14). [Rum.f.]

It was demonstrated that in plywood manufactured with pure synthetic-resin glues, the strength of specimens boiled in water for 3 hours was inferior to that of pieces soaked for 24 or 48 hours in water at room temperature. The difference in strength varied between wide limits, but in general the maximum difference may be taken as 25 per cent. Immersion in boiling water is not applicable to plywood manufactured with synthetic-resin glues containing a large proportion of other ingredients, or with casein glues. In these cases, boiling often causes delamination in a short time.

[1704]. 33.15.5. BERGIN, E. G. **The effect of high temperatures on casein and cold-setting urea-formaldehyde glues. Exposure tests on close-contact joints.** *Mimeo. For. Prod. Lab., Can.* No. 120, 1946. pp. 4 + tbls. + figs. P.R.

Data are given on casein and cold-setting urea-formaldehyde glues exposed to temperatures ranging from 72° F. to 194° F. under normal moisture conditions and tested in 'close-contact joints', i.e. surfaces bonded under pressures sufficiently high to ensure glue-lines of minimum thicknesses. Casein glues were least affected by being exposed to elevated temperatures and showed good resistance under temperatures as high as 194° F., whereas normal urea glues broke down very rapidly under such conditions. A urea-glue of the craze-resistant gap-filling type was little inferior to the casein glues.

33.17. Sawmilling

See also *For. Abstr.* 9 (No. 1629).

[1705]. 33.17 : 02.1. MULLER, J. L. **Establishing and operating a small sawmill business.** *Industr. Ser. U.S. Dep. Comm.* No. 20, 1945. pp. vi + 154. D.S.I.R.

A manual dealing with the establishment and operation of a small sawmill, i.e. a mill with a circular saw, usually not more than a 5-man crew, and producing less than 10,000 bd. ft. of timber a day. The location and equipment of the mill, logging and sawing methods, plant lay-out, piling and grading of timber, waste utilization and other problems connected with such an undertaking are fully dealt with.

[1706]. 33.17 : 07.7. **Circular saws.** *Cabinet Mkr.* No. 2498, 1947 (596–7). P.R.

Describes new tungsten-carbide-tipped models for cutting high-density plywoods, compressed and laminated plastic sheets and very hard natural timber. [Cf. *For. Abstr.* 9 (No. 1663).]

[1707]. 33.17 : 07.7. MIKHAYLOVSKI, YU. V. Avtotraktornye gazogeneratornye silovye ustanovki dlya privoda shpaloreznykh stankov. [**Producer-gas tractors as power for sleeper sawmills.**] *Lesnaya Prom.* 1947 (4), (7–9). [Russ.]

Details are given, with diagrams, of methods of using (1) the motor and gas-generator units of the ZIS–21 automobile, (2) the ChTZ type of producer-gas tractor, for driving sleeper sawmills.

[1708]. 33.17 : 38.2. KARPOV, L. S. Novaya konstruktsiya fundamentov pod lesopil'nye

ramȳ. **[New construction for frame-saw foundations.]** *Lesnaya Prom.* 1947 (1), (11). [Russ.]

A brief account of the design, with scale diagrams, of a frame-saw foundation for a machine weighing 9·5 metric tons and requiring only 27 instead of the 50–60 cu.m. of concrete necessary for the type of foundation previously used.

[1709]. 33.17 : 12.26–8 (943 : 945). WRIGHT, G. W. **Sawmill studies in Victoria and Queensland.** *Aust. Timb. J.* 13 (6), 1947 (369, 371, 373, 375, 377, 379).

Deals with the milling of 'Ash' Eucalypts [*E. regnans, E. gigantea, E. sieberiana*]. Among the factors investigated were sawn output per mill and per man hour; manufacturing margin, allocation of mill time; quantity of sawn timber, sawdust and waste wood produced in log conversion.

[1710]. 33.17 : 12.25 (943 : 945). WRIGHT, G. W. **Sawmill studies in Victoria and Queensland: Cypress Pine studies.** *Aust. Timb. J.* 13 (7), 1947 (441–2, 445, 447, 473, 475).

The Cypress Pine [*Callitris* spp.] mill studies differed from those on the 'Ash'-type Eucalypts [see preceding abstract] in that the emphasis was on the effect of log size rather than on that of size of sawn product. It was apparent that mill output increased appreciably as the girth class of the log handled increased. Man-day output also increases rapidly with increasing log size. In the smaller girth classes, increase in girth class slightly reduces recovery, but in the classes providing the bulk of logs (g.b.h. 21–38·9 in.) recovery remains almost constant at a value of about 70 per cent. It is concluded that the greatest economy of milling is given by girth classes exceeding 30–32·9 in.

33.3. *Chemical Treatment*

See also *For. Abstr.* 9 (Nos. 1615–9).

Use of Wastes

See also *For. Abstr.* 9 (Nos. 1716–17, 1773).

[1711]. 33.3 : 34.6. WARRICK, L. F. **Industrial wastes. Pulp and paper industry.** *Industr. Engng. Chem.* 39 (5), 1947 (670–6). P.R.

Reviews characteristics of chemical pulping and white-water (fibre) wastes, with respect to effects on waterways in which they are discharged, and methods of treatment and disposal or utilization. Tabulates results of the 1946 survey of wastes at Wisconsin pulp and paper mills.

[1712]. 33.3 : 34.6. WISE, L. E. **Hemicelluloses—their importance to the pulp and paper industry.** *Paper Ind.* 29 (6), 1947 (825–9, 834). P.R.

Briefly discusses hemicelluloses in relation to waste liquor and stream pollution, and their use in the manufacture of by-products of the paper industry; reviews research from 1933 to the present day on the effect of hemicelluloses on pulp properties and quality.

[1713]. 33.3 : 34.6. LAWRENCE, W. P. **Collection of sulphate turpentine.** *Paper Tr. J.* 124 (9), 1947 (128–34). P.R.

Summary, with tables, of results of a questionnaire sent to 24 mills, on equipment and operating conditions in the collection of sulphate turpentine with data of the yield from various softwood species, types of digester, separator and condenser, and methods of storage.

[1714]. 33.3 : 34.6. SOLODKI, F. T. Fitosterin sul'fatnogo mȳla. **[The phytosterol of sulphate soap.]** *Bumazh. Prom.* 21 (1/2), 1946 (32–6). [Russ.] [Leningrad Forest-Technical Academy.] L.S.

Experiments made by the All-Union Institute for Research on Fats have shown that sulphate soap can be added without further purification to the mixture of fats used in soap manufacture, and hence the need for purification only arises if valuable by-products, e.g. phytosterols, are to be utilized.

The yield of sulphate soap per metric ton of wood varies with the nature of the latter: resinous Pine pulpwood yields up to 50 kg. soap and more, Pine sawmill waste half that quantity, and Spruce wood none at all. About 10,000 metric tons of sulphate soap could be obtained annually with Soviet mills working at full capacity.

Phytosterol has been produced on an experimental scale at the Leningrad Forest-Technical Academy by dissolving the soap in alcohol, crystallization from the extract so obtained and recrystallizing once from alcohol. The soap

contains 1·5–3 per cent. of sterols, but the yield in practice is about 1 per cent. The product of the process mentioned has a melting point of about 120° C. Preliminary analyses indicate that it contains: (1) β sitosterol ($C_{29}H_{50}O$) of m.p. 136–137°; (2) a sterol ($C_{29}H_{48}O$) with two ethyl linkages, of m.p. 132°; (3) a sterol ($C_{29}H_{46}O$) with three ethyl linkages, of m.p. 140–141°. It is at present impossible to suggest structural formulae.

The chief uses at present envisaged for phytosterol from sulphate soap are in hormone preparations and in ointments for treating skin diseases. More work, however, is needed to improve the extraction process and to shed further light on the component sterols.

[1715]. 33.3 : 34.6. **Lactic acid from sulphite waste.** *Chem. Age, Lond.* 55 (1435), 1946 (810). P.R.

Summarizes results of laboratory experiments at Wisconsin University. The acid liquor was prepared for fermentation by steam stripping to remove sulphur dioxide and neutralizing to a slightly alkaline condition with slaked lime, and was then filtered. An inoculum was prepared of a lactic-acid-producing organism, *Lactobacillus pentosus*, on a rich medium. Fermentation took 40–48 hrs. at 30° C. The lactic acid was recovered by use of solvents. The acids were washed out of the solvent with water and this final aqueous solution was concentrated and the acetic acid distilled out. Assuming 2,000 gallons of waste liquor per ton of pulp and 95 per cent. recovery, 285 lb. of lactic acid and 75 lb. acetic acid may be obtained per ton. [Cf. *For. Abstr.* 8 (p. 600).]

33.32. Pulp and Paper Manufacture. Wallboards. Plastics

See also *For. Abstr.* 9 (Nos. 1586, 1602, 1711–15).

[1716]. 33.32 (431–5) : 34.6 : 33.32.1. McGovern, J. N. **Manufacture of pulp and paper and related products from wood in Western Germany.** *FIAT Final Rep. Brit. Intell. Obj. Sub-comm.* No. 487, 1945. pp. 178. P.R.

The German pulp and paper industry was found to be generally less advanced than elsewhere. The only developments were in certain normally subsidiary products to meet wartime needs, or in the use of pulp and paper products as substitutes for scarce materials. Under these headings are included the use of bleached Beech sulphite pulp for cellulose nitrate [cf. *For. Abstr.* 8 (No. 2568)]; the production of yeast on the sugars of waste sulphite liquor [cf. *For. Abstr.* 8 (No. 2615)]; evaporating and burning waste sulphite liquor to avoid stream pollution; sulphite spin paper for binder twine as a substitute for sulphate paper and sisal; and hardboard made from fiberized wood wastes. The report gives a full account of all processes used throughout the industry, accounts of visits to various plants, and an outline of the research in progress at the Technical High School, Darmstadt.

[1717]. 33.32 (431–5) : 34.6 : 33.1. Becker, D. **Wood pulp industry in Germany.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1386, Item No. 22, 1946. pp. 44. P.R.

Reports on technique, equipment and capacity of 3 mills producing pulp and paper, rayon pulp, breeze blocks from slag, flooring and wall-panelling tiles from wood waste, and yeast and alcohol from waste liquors; also on one mill producing wire cloth used in pulp and paper mills and by other industries.

[1718]. 33.32 (46) : 09.4 : 98.3. Disminuyen sensiblemente nuestras importaciones de papel y materias primas para su fabricación, y los precios siguen aumentando. [**Our imports of paper and raw materials for its manufacture show a marked decline, and prices continue to rise.**] *Montes, Madrid* 3 (13), 1947 (89–91). [Span.]

Figures are given for Spanish imports of paper, paper board and raw materials for pulping from 1933 to 1945. Imports of wood pulp decreased from 114,204 tons in 1933 to 26,947 tons in 1945.

[1719]. 33.32 (471) : 07.2. Nybergh, B. **Central Laboratory of the industries: a review of the latest developments of the industrial research organization in Finland.** *Pulp Paper Mag. Can.* 48 (10), 1947 (74–5).

[1720]. 33.32 (73) : 09.4. **Pulp and pulpwood statistics.** *Fibre Contain.* 32 (8), 1947 (123–8). P.R.

Gives figures for the American supply (domestic and imported) and consumption of

pulp and pulpwood from 1940 to 1946 and the first five months of 1947.

[1721]. 33.32 : 12.25 (472) : 33.02 : 56.02. ZHEREBOV, L. P. Balansy severa. **[North Russian pulpwood.]** *Bumazh. Prom.* 21 (1/2), 1946 (6–13). [Russ.] L.S.

In view of the increased demand for pulpwood under the present 5-year Plan it is considered expedient to use material from N. and N.E. Russian conifers grown on sites of low quality, and to include topwood, i.e. firewood, to replace which, other fuels (e.g. peat) should be used whenever possible.

Such wood is very fine-ringed, e.g. in stems 180–220 years old the outermost wood may contain 12–15 rings to the millimetre. Parallel sulphate cookings of narrow-ringed and normal wider-ringed material showed no significant difference in cellulose yield per unit weight between the two types; they may therefore be cooked under identical conditions, and the high specific gravity of the former should be advantageous from the point of view of pulp yield. The frequent presence of twisted fibre and excentric growth does not prevent the use of the wood for manufacturing high-grade pulp. The resin content of the wood somewhat exceeds that of the pulpwood normally exported, but the alcohol extractives found in high percentage in some samples appear to contain considerable quantities of humic or lignin-like substances as well as resins, and the former substances do not impair pulp quality. Considerable knottiness is undoubtedly a disadvantage which will often limit the use of the wood to the sulphate process or to the production of papers of only average quality, but efforts should be made to develop a better type of knot-separator. Methods should also be devised for recovering resins from resinous wood of both Pine [*Pinus sylvestris*] and Spruce [*Picea* spp.] before pulping.

[1722]. 33.32 : 12.25 (73) : 21.0. COOK, D. B. **European Larch as a pulpwood.** *J. For.* 45 (10), 1947 (763–4).

In the North-eastern United States *Larix decidua* makes rapid early growth, surpassing that of all other conifers and most hardwood seedlings. Volume production is equally good, and well stocked plantations at the usual 6 × 6 ft. or 8 × 8 ft. spacing need to be thinned early, often, and quite heavily. In order to find a possible use for these thinnings tests were made in pulping thinnings from a 16-year-old stand in New York. The results showed that European Larch is not suitable for pulping by the soda process; but that a satisfactory paper-making pulp can be obtained by the sulphite, semi-kraft, or kraft processes: Larch is slightly more difficult to pulp than Spruce, but the resultant pulps are of about equal strength. Yields are rather lower from Larch than from Spruce, but yields per cord should be almost identical, owing to the somewhat higher density of Larch.

33.32.1. *Pulp Manufacture*

[1723]. 33.32.1 : 12.26–8 : 33.32.2. HYTTINEN, A., MACKIN, G. E., and SCHAFER, E. R. **Experiments on the grinding of Quaking Aspen [*Populus tremuloides*] and use of pulp in printing paper.** *Paper Tr. J.* 125 (13), 1947 (53–62). P.R.

Describes experiments and tabulates the results. It was found that a dull stone surface is preferable to a sharp one for the production of Aspen pulp in the freeness range used for printing papers. For a given quality of pulp the production rate is higher and the energy consumption lower with a dull than with a sharp stone surface.

A comparison of the effects of speeds of 3,468 and 4,185 ft./min. at equal energy consumptions for a given stone-surface condition showed that the grinding rate and freeness were generally higher and the strengths generally lower for the higher speed.

A comparison of Spruce and Aspen ground under the same conditions showed a lower grinding rate, a higher energy consumption, higher strength, lower freeness, and shorter average fibre length for the Spruce. To produce pulps of equal strength, Aspen would require much higher energy consumption than Spruce.

Five Aspen groundwood pulps, each made with a different stone surface, were each used in three book-grade paper furnishes. Wet-web strength was found low, but no significant changes in paper-machine operation were required to meet the conditions established for a standard commercial book furnish. In general, the Aspen groundwood tended to produce a well formed sheet with good appearance; it tended, however, to cause higher sheet density, lower porosity and opacity and, with one or two

exceptions, lower strengths than were obtained when Spruce groundwood was used. The lower porosity reduced the amount of coating that could be applied, an objection that might be overcome by adjusting the proportional amounts and the types of pulps used. The Aspen groundwood did not impair the printability of the paper. *From authors' summary.*

[1724]. 33.32.1. BACKMAN, A. Flistjocklekens inverkan på cellulosa-utbyte och massakvalitet vid kok av parallellipipedisk flis. **[Influence of chip thickness on yield and quality of chemical pulp in cooking trials with chips in the form of parallelipipeds.]** *Medd. Industr. CentLab., Helsinki* No. 47, 1946. pp. 18. [Sw.e.] *Repr.* from *Papp. Trävaru Tidskr. Finl.* 1946 (13). P.R.

Sulphite pulping tests with *Picea abies* and sulphate pulping tests with *Pinus sylvestris* wood, chipped into regular parallelipipeds of varied thickness, showed that:—(1) Chip thickness had considerable influence on pulp yield and strength properties, there being marked maximum values correlated with definite thicknesses—mostly of about 3 mm. (2) Chipping to excessive thinness lowered different strength properties of the pulp to differing degrees. (3) In contrast to the regular correlations obtained in most cases, the tearing strength of strong sulphate pulp was more diffusely correlated with chip thickness and, though high in comparison with values for commercial sulphate pulps, was not of the order expected. A satisfactory explanation of this discrepancy cannot be offered until a more detailed investigation has been made. There are nevertheless indications that higher tearing strengths should be attainable in sulphate pulps than those at present normally obtained.

The known fact that pulp from chips made in a mill chipper is not ordinarily as strong as that from hand-cut chips of the same log, seems to be due less to differences in external form than to lamellation caused by mechanical chipping, whereby the effective average chip thickness is reduced to below 3 mm.

Parallel cooking trials with hand-made chips 3 mm. thick and mechanically made chips, should be a good test of the value of chipping equipment and procedures.

[1725]. 33.32.1 : 12.25. BRAY, M. W., and SINGER, B. **Influence of sodium sulphite and sodium thiosulphate in the sulphate pulping of Engelmann Spruce.** *Paper Tr. J.* 125 (8), 1947 (49–53). P.R.

Tabulates the results of experiments on the comparative effects of sodium sulphite, sodium sulphide and sodium thiosulphate, with caustic soda, in pulping Engelmann Spruce. Sodium sulphite and sodium thiosulphate used with caustic soda gave pulp with better strength properties than from the use of caustic soda alone, but inferior to kraft pulp. When either was used to replace half the sodium sulphide of kraft liquors in such quantity as to maintain the original reducing power, pulps considerably stronger than kraft pulp were obtained. When the reducing power of kraft pulp was doubled by the addition of either sodium sulphite or sodium thiosulphate some strength properties were increased. The results indicate that sodium thiosulphate released by reactions of sulphur and caustic soda in the soda-sulphur process is of use as a delignifying agent and in the increase of strength properties, and that by-product sodium sulphite might usefully be added to kraft cooking liquors.

[1726]. 33.32.1 : 31.3. PENNINGTON, D., and RITTER, D. M. **A diffusion study of lignin sulfonic acids in sulfite waste liquor.** *J. Amer. chem. Soc.* 69 (3), 1947 (665–8). D.S.I.R.

Tabulates results of experiments showing diffusion coefficients of the lignin sulphonic acids over successive intervals of diffusion. Calculations made by applying the Sutherland-Einstein equation to the diffusion coefficients show that the lignin sulphonic acids vary in molecular weight from 3,000 to 10,000 or more. The non-ligneous substances present appear to be of low molecular weight. *From authors' summary.*

[1727]. 33.32.1. MELLER, A. **The cold alkaline purification of wood cellulose. 1. Some effects of bleaching and acid hydrolysis on resistant pentosans.** *Paper Tr. J.* 124 (9), 1947 (104–6, 110–4). P.R.

Outlines existing theories of the association of resistant pentosans with cellulose in wood pulp and tabulates the results of experiments designed to decrease the resistant pentosan fraction in softwood pulps by hydrochlorite bleaching and acid hydrolysis. Both treatments of pre-bleached pulp gave products with similar viscosity in cuprammonium solution. The percentage of soluble material removed by

cold 7-per-cent. sodium-hydroxide solution was greater from the bleached than from the hydrolysed pulp, and the bleached pulp contained a smaller amount of resistant pentosan for the same viscosity in cuprammonium solution.

[1728]. 33.32.1 : 12.25 : 12.26–8. MELLER, A. **The cold alkaline purification of wood cellulose. 2. The influence of surface properties on resistant pentosans.** *Paper Tr. J.* 125 (11), 1947 (57–60). P.R.

Describes experiments for studying the influence of surface properties of wood pulps, conditioned by drying, beating and sorting, on the removal of hemicellulose by 7-per-cent. cold alkali solution and tabulates and discusses the results. (1) Drying: the total hemicellulosic materials removed decreased when the heat drying was not accompanied by drastic depolymerization as measured by the viscosity in cuprammonium solution. When heat drying caused a great decrease in viscosity, the total of hemicelluloses removed increased slightly. As a result of drying at a higher temperature, the resistant pentosan content and the removal of non-pentosan materials (chiefly cellulose and its degradation products) increased in almost all instances. (2) Beating: this reduced the resistant pentosan content, but the reduction is reversed by drying at higher temperatures. (3) Sorting: the viscosity in cuprammonium and the resistant pentosan content of the coarse fraction (+ 60 mesh) of a bleached hardwood (Eucalypt) sulphate pulp were higher than those of the parent material. *From author's summary.*

[1729]. 33.32.1. MITCHELL, C. R., and YORSTON, F. H. **Relation between chlorine number and permanganate number of kraft pulps.** *Pulp Paper Mag. Can.* 48 (9), 1947 (83–4).

Both the chlorine number and various permanganate numbers are widely used as measures of the degree of delignification of chemical pulps. In experiments made to compare the two measures, it was found that the standard error of estimate of permanganate number was much higher than 0·2 (the figure within which duplicate determinations of permanganate number usually agree). It is possible that the error inherent in the determination of chlorine number is relatively large and thus leads to large errors in the estimate of the corresponding permanganate number. It seems more probable, however, that the two tests do not, in fact, measure exactly the same thing.

[1730]. 33.32.1. MASON, S. G. **The specific surface and electrokinetic potentials of cellulose fibres.** *Pulp Paper Mag. Can.* 48 (10), 1947 (76–80).

A brief review of the measurement of the specific external surface area and the surface potentials of cellulose fibre suspensions is presented, and representative results discussed. Of the existing techniques for measuring surface area, the permeability method is considered to be the most promising.

While many of the phenomena involved in fibre flocculation, size precipitation, filler retention, pitch control, etc., are often explained on the basis of changes in the zeta-potential, measurements of this quantity have not been sufficiently extensive to establish conclusively the validity of this type of reasoning.

Further work, some of which is currently in hand at the Pulp and Paper Research Institute, to clarify the role of both quantities in determining the properties of fibre suspensions is outlined. *Author's summary.*

33.32.2. *Paper Manufacture*

[1731]. 33.32.2 (431–5) : 07.7. WILTSHIRE, W. A., CARTER, W. J., and AIKMAN, A. J. C. **German papermaking industry.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1041, Item No. 22, 1946. pp. 168 + dgms. P.R.

An account of visits to 21 German paper mills with descriptions of machinery and techniques.

[1732]. 33.32.2 (431–5). GRANT, J., FERGUSON, T. A., MACKILLOP, J. W., and SHAW, J. L. **German vegetable parchment industry.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1137, Item No. 22 [*n.d.*], pp. 40. P.R.

Covers the manufacture of base paper, methods of parchmentizing and the machinery used.

33.32.3. *Wallboards, Fibreboards, etc.*

See also *For. Abstr.* 9 (Nos. 1600, 1827–8, 1839).

[1733]. 33.32.3. **Insulation board, wallboard, and hardboard.** *Rep. U.S. For. Prod. Lab., Madison* No. R1677, 1947. pp. 5 + 2 tbls. P.R.

Defines the 3 types of board, and briefly describes their manufacture and properties, giving specifications of minimum requirements.

[1734]. 33.32.3 (431–5). PORTER, P. W., PIPER, H. J., BALLANTYNE, J., and PYNER, G. **Investigation of targets connected with the manufacture of fibre building boards in Germany.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 989, Item No. 22, 1946. pp. ii + 136. P.R.

Cf. *For. Abstr.* 8 (No. 440).

[1735]. 33.32.3 : 33.1 : 34.6. SCHWARTZ, S. L., PEW, J. C., and SCHAFER, E. R. **Experiments on the production of insulating board and hardboard from western sawmill and logging waste.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1680, 1947. pp. 9 + 4 tbls. P.R.

Discusses and tabulates the results of experiments made on 8 types of waste from logging processes and veneer- and sawmills. All the pulps were subjected to a steaming treatment of ½ hour to 180° C. and ¼ hour at 180° C., while Western Hemlock slab-and-edging waste was, in addition, softened by other agencies, including water, sodium sulphite, caustic soda and lime. The pulps were subjected to freeness tests, and the finished boards to tests for water absorption and strength.

From the tests of cooking methods on Western Hemlock it appeared that steaming was the best from the point of view of simplicity of process and strength of product.

Satisfactory insulating boards and hardboards were obtained from Western Hemlock slabs, and edging and veneer wastes, and from White Fir logging waste, but the strength of board made from Western Hemlock planer ends was low. Boards from Douglas Fir wastes were of marginal quality and finely divided Douglas Fir planer shavings proved quite unsuitable. Better results might possibly be obtained from Douglas Fir wastes by use of cooking methods other than steaming.

[1736]. 33.32.3. **Wood is now a big ingredient in Celotex.** *Timb. & Plyw.* 93 (2401), 1947 (86). P.R.

Wood fibre has partially replaced bagasse in the manufacture of 'Celotex' soft fibreboard. Ingredients are now bagasse 50 per cent., coniferous wood fibre 25 per cent., and paper waste 25 per cent. The wood is crushed and reduced to a fibrous mass before being mixed with the bagasse and waste paper.

33.32.4. *Plastics*

See also *For. Abstr.* 9 (No. 1784).

[1737]. 33.32.4. **New synthetic resins and derivatives.** *Paint Technol.* 12 (139), 1947 (267–70). P.R.

Summarizes patent specifications. Improved resistance to moisture, decrease in brittleness and a higher melting point are obtained by modifying polymerized rosin with a fusible resin and a plasticizer. Resistance of polymerized rosin to oxidation, light, heat and abrasion may be increased by hydrogenation.

[1738]. 33.32.4 : 33.15.1. **New plastic wood filler for plywoods.** *Timb. & Plyw.* 42 (2383), 1947 (272). P.R.

'Plasto-Fil' is an American plastic made from wood and with the same expansion and contraction quotient as kiln-dry woods, for use as a filler in core voids in plywood and as a face-patching material for wood and plywood generally.

[1739]. 33.32.4 : 33.15.3. STAMM, A. J. **Wood and paper-base plastics.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1438, 1946. pp. 9 + tbls. + figs. P.R.

33.33. Manufacture of Textiles from Wood

[1740]. 33.33 (44). PIERRE, B. Une industrie du bois: les textiles artificiels. [**A wood industry: artificial fabrics.**] *Rev. Bois Appl.* 2 (1), 1947 (17–25). [F.]

Describes methods of rayon manufacture and the development of the industry in France.

33.36. Preservation of Wood. Seasoning and Drying

[1741]. 33.36 : 31.42.1 : 31.43 : 31.45 (431–5). FLÜGGE, R. Die gesamte Schutzbehandlung des Bauholzes. [**The protection of constructional timber.**] Carl Marhold Verlagsbuchhandlung, Halle (Saale). 1943. pp. 132. [G.] Price RM. 3.20 (3*s.* 6*d.*) P.R.

Discusses the damage caused by fungi (including those which attack the standing tree), by insect attack and fire; also the methods of

application and effectiveness of preventive treatments. Gives tables of German proprietary preservatives and fire-retardants, with their chemical nature and use. Discusses treatment of timber for special purposes—railway sleepers, pit timbers, under-sea constructions, etc.

33.36.1. *Preservation against Attack by Plants and Animals*

See also *For. Abstr.* 9 (Nos. 1758–63, 1774, 1780).

[1742]. 33.36.1. BRYAN, J. **Methods of applying wood preservatives. Part 1. Non-pressure methods.** *Rec. For. Prod. Res., Lond.* No. 9, 1946. pp. 13. P.R.

Reviews surface, steeping, and open-tank treatments, with graphs of the degree of absorption of creosote under different conditions, and lists the commoner European timbers and their resistance to impregnation.

[1743]. 33.36.1 : 31.43 : 33.31 : 13.2 : 12.25. KELSEY, J. M. **A preliminary report on timber preservation with Wolman Tanalith in New Zealand.** *N.Z. J. Sci. Technol.* 28B (3), 1946 (136–44). P.R.

Cf. *For. Abstr.* 9 (No. 1117).

Tabulates results of tests to determine the degree of protection against *Anobium punctatum*, afforded by an average retention of dry salt of 2·5 lb./cu. ft. in *Pinus radiata* treated when green. Describes tests made on the heart- and sapwood of treated and untreated controls by egg-laying and by transferring larvae from untreated timber. Notes use of Tanalith-treated timber in other countries.

[1744]. 33.36.1 : 31.43 : 33.31 : 13.2 : 12.25. KELSEY, J. M. **A preliminary report on timber preservation with Celcure for New Zealand grown *Pinus radiata*.** *N.Z. J. Sci. Technol.* 28B (3), 1946 (145–53). P.R.

Tabulates and discusses results of experiments with blocks of *Pinus radiata* pressure-treated with Celcure 6 years before and with untreated control blocks. *Anobium* larvae emerging from eggs laid on the treated blocks were dead within 3 months; larvae transferred to the treated blocks survived 2–8 months longer. Larvae on untreated blocks were still healthy at the end of this time. Notes use of Celcure-treated timbers in other countries.

[1745]. 33.36.1 : 31.43 : 13.2 (73). TURNER, N. **Termite control—1947 model.** *Pests* 15 (5), 1947 (12–16). D.S.I.R.

Discusses generally the fundamental principles of termite control in already infested constructions by determining the points of entry, breaking the contact between wood and soil at these points, chemically treating the soils, and, as a further safeguard where possible, impregnating damaged but structurally safe timbers.

[1746]. 33.36.1 : 33.31. **Standard specification for carbolineum and creosote for the preservation of timber.** *S. Afr. Stand.* No. 17, 1943. pp. 15. P.R.

[1747]. 33.36.1 : 33.31. LEAR, W. L. **A limited study of pressure treating schedules with pentachlorophenol.** Southern Pine Association. 1947. pp. 8 + 2 + 10 gphs. P.R.

Discusses results of experiments made to determine the suitability of pentachlorophenol for comparatively short treating cycles in small pressure-treating plants, using a solution of 5 per cent. by weight of pentachlorophenol in a light petroleum oil. The materials treated were Southern Pine and Red Oak posts, and the Lowry and Rueping schedules were both used. The absorptions for the different charges are given in graphs. In the Lowry schedules excessive absorptions were obtained; in all samples the sapwood was penetrated completely and the heartwood to an undetermined extent. In the Rueping schedules absorption varied considerably with the initial air pressure. While the volume of wood treated was insufficient for developing definite treating schedules, the results indicate that relatively short treating cycles are possible with pentachlorophenol in the type of oil used.

[1748]. 33.36.1 : 33.31 : 31.42 : 12.21 : 33.8. TIPPO, O., WALTER, J. M., SMUCKER, S. J., and SPACKMANN, W. **The effectiveness of certain wood preservatives in preventing the spread of decay in wooden ships.** *Lloydia* 10 (3), 1947 (175–208). P.R.

Discusses tests on the effectiveness of various repair procedures, and of different preservatives, in preventing the spread of decay

from infected timbers to sound timbers in ships.

Southern Yellow Pine test panels, each consisting of three blocks, were employed in the investigation. One of these blocks was first infected throughout with *Poria xantha*, and thus made equivalent to a decaying timber, and used as an inoculum block. Several sets of these panels were treated with copper naphthenate, chlorinated phenols, or phenyl mercury oleate. For each of these three preservatives, one set of panels was prepared in which the inoculum blocks were brushed with the preservative and the other two blocks were given the hot-and-cold-bath treatment in the same preservative; in a second set all the blocks were brushed with the preservative; in a third set only the inoculum blocks were brushed with the preservative; and finally a fourth set was left untreated throughout. The treated and assembled panels were exposed in a humidity chamber for a year and a half. At the end of this time the panels were disassembled and observations made on the blocks for the presence of decay.

The results are tabulated and the following conclusions drawn: (1) The chlorinated phenols and phenyl mercury oleate (at 0·5 per cent. concentration) were definitely superior to copper naphthenate in preventing the spread of decay from infected to sound wood. (2) Solutions containing 0·1 per cent. and 0·2 per cent. of phenyl mercury oleate were not effective against decay. (3) The protection against decay offered by the hot-and-cold-bath method of applying preservatives was superior to the protection given by the one-coat brush method. (4) The different treating combinations used in applying the preservatives may be arranged in the following order of probable effectiveness against decay: (*a*) Treatment of wood used in making replacements with the hot-and-cold-bath method and brushing the adjacent old timbers with the preservatives. (*b*) Hot and cold bath for the replacements but no treatment of adjacent old timbers. (*c*) Brushing all wood with preservatives. (*d*) Brushing the old wood with preservative and using untreated wood in making replacements. (*e*) Leaving all the wood untreated.

It is recommended that in repairing ships with decayed timbers: (1) The rotting timbers and all wood to a point one or 2 ft. beyond the visibly infected area should be removed. (2) All paint be removed from the remaining surrounding wood to a distance of several feet and this wood be swabbed with a preservative. (3) Heartwood of those timbers which have considerable natural decay resistance be used in the replacement of the decayed wood. (4) The new replacing timbers should be treated with preservative either by swabbing or by the hot-and-cold-bath method. (5) The source of damp which contributed to the development of the decay should be located and eliminated. *Authors' summary.*

[1749]. 33.36.1 : 12.11.14 : 12.25 : 33.53. BURTON, R. E. **A sap stream process of treating second-growth Redwood poles.** *J. For.* 45 (10), 1947 (762–3).

A method of treating second-growth Redwood [*Sequoia sempervirens*] trees for transmission-line poles has been employed for the last 6 years by the Coast Counties Gas and Electric Company of Santa Cruz, California, with considerable promise of success. The method consists in placing the base of the cut tree, immediately after felling, in a preservative solution such as zinc chloride or chromated zinc chloride, thus allowing the entire tree to draw the solution. Care was taken, while felling trees, to preserve as many of the branches as possible. Various types of reservoir were devised and clamped to the base of the trees to be treated [one made from an inner tube is illustrated]. Solutions of different strengths were tried and it was found that 1-per-cent. solutions gave the best penetration and greatest amount of chemical salts per unit volume of wood. Treatment took about 8 days per pole, during which time a typical tree, 14 in. in diameter (inside bark), and 40 ft. long (to a diameter of 6 in. inside bark) would absorb the equivalent of 4·5 lb. of dry zinc chloride per 16·35 cu. ft. of sapwood, or about 1·25 per cent. of its dry weight. At current prices this was equivalent to a cost of $0.54 for the preservative. All trees do not react alike, and the season of the year makes a difference. May, June and July were found to be the best months. The rate of travel of the solution was ascertained by means of an indicator and it was found that in a little over 2 hours some of the zinc-chloride solution would travel the entire length of a 50-ft. tree and could be detected in the branches as well as the stem. The greatest absorption took place between 11 a.m. and

4 p.m. Trees felled so that their branches were in the sun took in more solution than those in the shade. Changes in atmospheric pressure had no marked influence on the flow of solutions. Tests on increment borings showed that each segment of the base is connected to the upper portion of the tree by definite fibro-vascular bundles that run in counter-clockwise lanes, making a complete turn in 50 ft. or more. It is therefore essential that the entire base should be immersed, so as to secure complete treatment.

Treated and untreated poles were buried 3 ft. deep in a moist soil in 1941. In 1946 the treated poles were practically intact, and the untreated ones were entirely decayed to the heartwood. Other treated poles which were tried in power-line service for 5 years showed no weakening or deterioration from either fungi or insects. The checking due to drying does not expose susceptible wood tissues, neither does the drilling of the poles for cross arms and cleats. Since there is little lateral motion of the salts in these treated poles, rain is able to leach out only a very thin outer portion. It was noted that the branches trimmed off the treated poles resisted insects and decay on the forest floor.

Records were kept of the cost of labour and material, which worked out at $9.6 per pole, the value of the treated pole being estimated at $15.

[1750]. 33.36.1 : 33.5 (689). LEWIS, W. E. **The preservative treatment of poles and timber.** *Nyasald. agric. quart. J.* 6 (4), 1946 (81–93). D.S.I.R.

Lists Nyasaland timbers naturally resistant to decay and termite attack; discusses common preservatives and methods of preservation; and describes an improvised adaptation of the open-tank treatment for poles and small timber, suitable for use in Nyasaland, using one part of concentrated cattle dip, in which the main active ingredient is sodium arsenite, to 18 parts of water. This treatment adds about 6 years to the life of the timber.

33.36.2. *Fireproofing*

See also *For. Abstr.* 9 (Nos. 1741, 1774).

[1751]. 33.36.2 : 33.15.2. JORDAN, L. A. **Reduction of fire risks in ships.** *Nature, Lond.* 160 (4059), 1947 (216–7).

In 1944 work was begun by the Admiralty Chemical Department, Portsmouth, to devise an efficient method of fireproofing small wooden articles such as plywood cases for radio equipment. The standard method of fireproofing wood in bulk by impregnation with mono-ammonium phosphate solution was found unsatisfactory owing to the relative slowness with which aqueous solutions are absorbed by wood. Moreover, in the case of plywood, these would cause distortion through attack on the adhesives. Examination of a wide range of materials showed that urea phosphate, which is readily soluble in alcohol, possessed good fireproofing qualities; and an alcoholic solution with a small proportion of wetting agent added was found to give the desired speed of impregnation. The most satisfactory procedure involved simple immersion of the article to be treated, in a hot solution (20–30 per cent. strength by weight) of urea phosphate in industrial methylated spirits for about one hour. The excess was then allowed to drain off, and the article left to dry. Alternatively, though less satisfactorily, in cases where immersion is impracticable, a series of brush applications can be substituted. Large-scale trials at the Admiralty Fire Testing Ground, Haslar, confirmed the efficiency of the process, which has been patented and assigned to the Admiralty.

33.36.3. *Seasoning. Drying*

See also *For. Abstr.* 9 (No. 1789).

[1752]. 33.36.3. NAJERA Y ANGULO, F. El problema de la desecación de la madera. Estudio de los sistemas y procedimientos actualmente empleados. **[The problem of wood seasoning. Study of systems and processes now in use.]** *Montes, Madrid* 3 (13), 1947 (31–44). [Span.]

An account of the theory and practice of seasoning, with a description of various types of kiln and a table showing the average equilibrium moisture contents of seasoned wood [no species mentioned] in 55 towns of Spain and her colonies.

[1753]. 33.36.3 : 31.22.3. BAKER, W. J. **How wood dries.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1642, 1947. pp. 8. P.R.

[1754]. 33.36.3 : 07.7. KIMBALL, K. E. **Testing commercial kilns for uniformity of drying conditions.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1643, 1947. pp. 8 + 8 dgms. P.R.

Describes the preliminary inspection necessary, methods of checking the longitudinal temperature range and how to determine kiln temperature cycles.

[1755]. 33.36.3 : 07.7. KIMBALL, K. E. **Construction and use of graphs in kiln drying lumber.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1659, 1947. pp. 4 + 5 tbls. + 6 gphs. P.R.

Discusses the general principles for the construction of graphs and their value to kiln operators, giving examples to show relationships between moisture content and length of drying, temperature-time cycles, moisture distribution during drying and variations of temperature at different places within the kiln.

[1756]. 33.36.3 : 34.6 : 33.1. **Drying lumber with burner heat.** *Timberman* 48 (11), 1947 (68).

Brief account of a method for seasoning Redwood lumber with radiated heat from a sawmill-waste burner.

[1757]. 33.36.3. **Special methods of seasoning wood. Boiling in oil. Superheated steam. Solvent seasoning. Vapor drying. Infra red radiation. Vacuum drying of wood.** *Rep. U.S. For. Prod. Lab., Madison* Nos. *R*1665 and *R*1665/1–5, 1947. pp. [11]. P.R.

[1758]. 33.36.3 : 33.52 : 12.26–8 : 33.36.1. **Vapor drying process on crossties. 1. Red Oak crossties. 2. Black Gum crossties.** *Tech. Rep. Taylor-Colquitt Co. Res. Lab.* No. 32–A, 1943. pp. 28 + tbls. + plates. P.R.

A report of vapour-drying tests on sleepers of Red Oak and Black Gum using a coal-tar distillate with an atmospheric boiling point of about 320° F. as a drying medium. [See *For. Abstr.* 8 (p. 189) and 8 (No. 2606)]. After drying, the sleepers were impregnated with a 60/40 creosote/coal-tar solution. Details of the drying and impregnating cycles and results include the following:—

	Red Oak	*Black Gum*	
Heating cycle	12	12	hrs.
Vacuum cycle..	2½	2–2½	„
Average initial moisture content.	70·4	58·9	per cent.
Average final moisture content	28·1	26·6	„
Average volumetric shrinkage:			
From green to vapour dried state.	5·4	3·9	„
From green to treated state	4·8	3·4	„
Average water removal:			
During heating cycle ..	13·11	8·61	lb./cu.ft.
During vacuum cycle ..	1·97	1·22	„
Average retention of drying medium.	·39	1·34	„
Average retention of 60/40 solution.	7·44	7·04	„
Average gross injection of 60/40 solution.	14·86 (for 6 of the charges).	17·03	„

In the tests on Red Oak the wetter charges were found to lose more moisture in a given time than the drier ones. Retention of the drying medium depended on length of drying cycle. In pressure treatment, shorter pressure periods were used and better penetration obtained than for air-dried material, the higher temperature of the vapour-dried wood inducing a freer flow of preservative. In vapour-dried sleepers, moisture gradients were steeper than in air-seasoned sleepers and external checking was less. The moisture gradients were less steep in vapour-dried Gum sleepers than in Oak and there was less internal checking.

[1759]. 33.36.3 : 33.52 : 12.26–8 : 33.36.1. **Vapor drying report: vapor drying tests on Gum crossties.** *Tech. Rep. Taylor-Colquitt Co. Res. Lab.* No. 36–A, 1944. pp. 24 + tbls. + plates. P.R.

An account of vapour-drying and creosote-impregnation tests on Red and Black Gum sleepers of different initial moisture contents. A coal-tar distillate (K–4) was used as the drying medium and a 60/40 creosote/coal-tar solution as the preservative. Three straight cycles were run, using the K–4 at its atmospheric boiling point (325–330° F.), for 12, 6 and 3¾ hours, and then three lower temperature runs using a vacuum to lower the boiling point of the K–4. Sleepers with a high initial

moisture content lost correspondingly higher amounts of water in drying cycles of the same duration, dry and wet converging towards the same final moisture content. The amount of water removed in vacuum was the same regardless of duration of the vapour cycle but was less than normal with the K–4 boiling point lowered by vacuum during the vapour heating cycle. An increasingly high retention of drying oil resulted from increasing depths of vacuum used for this purpose and also from the longer drying cycles. The higher the K–4 retention, the lower was the retention of 60/40 solution. A deeper penetration of preservative was obtained than with air-seasoned sleepers. Internal checking was appreciable in only three of the charges and not enough to cause impor- that strength reductions.

[1760]. 33.36.3 : 33.52 : 12.26–8 : 33.36.1 : 31.27. **Strength test report. Tests of compression perpendicular to grain on vapor dried Gum crossties.** *Tech. Rep. Taylor-Colquitt Co. Res. Lab.* No. 36–B, 1944. pp. 4 + tbls. + plates. P.R.

Strength tests were made on Gum sleepers vapour-dried and creosoted as in report No. 36–A [cf. previous abstract]. Specimens taken before and after treatment were tested for strength in compression perpendicular to the grain. Those from the two 12-hour runs at 325° F. showed an average strength reduction of less than 10 per cent. The charges run at 250° F. for 12 hours and 220° F. for 15 hours, which had the lowest drying rates, showed a greater strength loss than the low temperatures would lead one to expect. It is thought that the long duration of the cycle and fairly high moisture contents during the run caused more loss in strength through hydrolysis than where the temperatures were higher.

[1761]. 33.36.3 : 33.52 : 12.26–8 : 33.36.1. **Vapor drying process. Charge No. 2. Main Plant. Oak crossties.** *Tech. Rep. Taylor-Colquitt Co. Res. Lab.* No. 52, 1945. pp. 15 + tbls. + figs. P.R.

Vapour-drying and creosoting tests were made on 13 trams of Oak sleepers, two of which contained partially air-seasoned sleepers and seven of which were stickered. A comparison is drawn between data for the stickered and unstickered loads and between the initially partly seasoned and the green loads.

[1762]. 33.36.3 : 33.52 : 12.26–8 : 33.53 : 12.25. HUDSON, M. S. **The vapor drying process.** *Repr.* from *Bull. Ntheast. Wood Utiliz. Coun.* No. 18 [*n.d.*]. pp. 15. P.R.

Data are given for vapour-drying tests on Red Oak sleepers, using three petroleum drying agents with boiling points ranging from 250° F. to 325° F. Graphs illustrate the internal temperatures attained and the effects of moisture content and temperature on rates of drying. A comparison of costs for air-dried and vapour-dried sleepers, and steamed and vapour-dried Pine poles is tabulated.

[1763]. 33.36.3 : 33.53 : 12.25 : 33.36.1. HUDSON, M. S. **Poles seasoned quickly in hydrocarbon atmosphere.** *Repr.* from *Elect. World, N.Y.* Sept. 14 and Sept. 28, 1946. pp. [6]. P.R.

Describes the application of the vapour-drying process to Southern Yellow Pine poles. Vapour-dried poles are stronger than steamed by 20–25 per cent. and are more easily penetrated by creosote preservatives. A short vapour-drying cycle after pressure treatment eliminates bleeding.

33.37. Distillation. Manufacture of Tar

[1764]. 33.37 (73) : 33.38. BEGLINGER, E. **Hardwood-distillation industry.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*738, 1947. pp. 20. P.R.

Lists the principal products of the industry and some of their uses, and briefly discusses commercial methods of wood distillation, the refining and recovery of crude products, and processes for utilizing sawdust and other wood waste by destructive distillation.

[1765]. 33.37. ARIES, R. S. **The continuous process of wood distillation.** *Timber of Canada* 8 (1), 1947 (75, 148, 150, 153, 154, 157, 158).

Describes the equipment and processes, with analysis of cost, for the continuous production of charcoal by the circulating gas method.

[1766]. 33.37 : 07.7. **A continuous charcoal manufacturing process.** *Chem. & Engng. News* 25 (30), 1947 (2162). P.R.

In an apparatus developed by the Polytechnic Institute of Brooklyn, wood is continuously fed into the top of a vertical oven by

an air-tight loading device. A stream of hot inert gas rises through the lowest wood, heating it to carbonization temperature and, rising higher in the oven, warms and dries the wood charge, finally leaving the oven at a temperature just above 212° F. The charcoal is continuously withdrawn from the bottom by a special device. The tar, wood-alcohol and acetic-acid vapours are drawn off at the top with the circulating gas. The tar is removed, the wood alcohol and acetic acid condensed and collected, part of the gas recirculated and part released to the air.

[1767]. 33.37 (44). GUISLAIN, A. La fabrication synthétique du méthanol à base de bois. **[The manufacture of synthetic methanol from wood.]** *Rev. Eaux For.* 85 (8/9), 1947 (526–33).

Description of a continuous process of wood distillation in use at the Décazeville pilot plant, using the Lacotte apparatus. The process produces a synthetic gas of great chemical purity, which needs only to be submitted to a catalytic process in order to obtain methanol. Yield of methanol is about 3 hectolitres per ton of wood at 20–25 per cent. humidity. All species of wood, hardwoods as well as softwoods, are used and are prepared in a Maier chipper which will deal with billets up to 14 cm. in diameter. The process makes the maximum use of the wood, and almost the only waste product is a very little ash. [Cf. *For. Abstr.* 9 (No. 1139).]

[1768]. 33.37 : 12.25. LOMBARD, R. Note sur la composition de l'essence de goudron de pin, ou Kiénöl, provenant du pin maritime. **[Note on the composition of Pine tar oil, or 'kienöl', from *Pinus pinaster*.]** *Bull. Soc. chim. France* Fasc. 11/12, 1946 (598–604). [F.] O.R.S.

An analysis of the most volatile constituents of the oils produced by distillation of *Pinus pinaster*, with particular reference to their terpene content.

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-Gas Generators

See also *For. Abstr.* 9 (Nos. 1586, 1764–6).

[1769]. 33.38 (485). BERGSTRÖM, H., and JANSSON, H. Leveranskontroll och analysmetoder för träkol. **[Control of supply and methods of analysis of wood charcoal.]** *Jernkontorets Ann.* 130 (3), 1946 (89–117). [Sw.] L.S.

Considers the properties necessary for charcoal used in the iron industry and for the manufacture of producer gas; gives rules for estimating the quantity of charcoal in a railway truck and for taking samples for analysis; and describes methods for ascertaining dry weight, brittleness, water content, tendency to spontaneous combustion, percentage of oxygen absorbed and carbon dioxide given off, and the carbon, tar, ash and phosphorus content.

[1770]. 33.38.1. PINEL, A. Procédé de carbonisation des matières cellulosiques. **[Method of carbonizing cellulosic materials.]** *Fr. Patent* No. 905,433, Dec. 4, 1945. [F.] *Chim. et Industr.* 57 (1), 1947 (38). D.S.I.R.

Cellulosic material is soaked in a dilute solution of H_2SO_4 at 66° Bé. Amount of solution used is 2 to 4 per cent. by weight of the dry material. Carbonization is then carried out at a low temperature, usually between 60 and 100° C., to give a yield of 75–80 per cent. of charcoal. This is finally washed or neutralized with an alkaline solution.

[1771]. 33.38.1. FREDERICH-BLANC, F., FABRE, R., and GARNIER, A. Procédé pour éliminer les goudrons pendant la fabrication du charbon du bois. **[Method of eliminating tars during wood charcoal manufacture.]** *Fr. Patent* No. 892,288, Apr. 3, 1944. [F.] *Chim. et Industr.* 53 (3), 1945 (174). D.S.I.R.

A sudden rise in temperature in the kiln is obtained by opening all flues and vents and allowing an inrush of oxygen. The escaping smoke first becomes thick and white, then heavy and brown. When it returns to its original bluish colour the vents are closed. The process is repeated every 20 to 30 minutes until no thickening and darkening of the smoke is observed.

[1772]. 33.38.2. ALEXANDRE, A. Procédé de fabrication d'éthane par gazéification du bois. **[Method of manufacturing ethane from wood.]** *Chim. et Industr.* 55 (6), 1946 (415–23); 56 (1), 1946 (21–5). [F.] D.S.I.R.

The wood is first roasted and then decomposed by introducing carbon which is made incandescent by blowing in air or O_2 in a container heated to 1,000° C. The O of the

wood with that from the injected air or O_2 combines with the C to form CO. At 1,000° C. neither water nor hydrocarbons can be formed; the H of the wood cannot therefore combine with its C or O, nor, since no C or O is left free, can H compounds be formed when the gases are reduced in temperature. Thus any waste of H, usual in gas generators for motor vehicles by the discharge of large amounts of water vapour, is prevented. The gas, rich in H_2, is finally used to hydrogenate C_2H_2 to C_2H_6, which is separated and collected by liquefaction. The practical application of these principles to industry is discussed.

33.39. Manufacture of Sugar, Oils, Alcohol, and Miscellaneous Chemical Products from Wood

[1773]. 33.39 (431–5) : 33.32.1 : 34.6. CLAYSON, D. H. F., and LEDINGHAM, G. A. **Developments in pure and applied microbiology in Germany (American, British and French zones) during World War II.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 236, Item No. 22 [*n.d.*]. pp. 52 + 1 plate. P.R.

Contains a section on the production of protein by microbiological methods. These deal with the growing of Torula yeast on wood sugars by the Bergius and Scholler processes [cf. *For. Abstr.* 8 (Nos. 522–3, 1282, 2616)] and the production of *Oidium lactis* on waste sulphite liquor; this last process had been conducted on a fairly large scale, but the product (used as a protein supplement in sausage manufacture) was not passed for human consumption by the German food ministry and production was stopped.

33.4. *Converted Structural Timber*

See also *For. Abstr.* 9
(Nos. 1612–4, 1686, 1698, 1790–2).

[1774]. 33.4 : 31.4 : 33.36 : 31.27 : 31.21.4. GEIGER, F. Das Bauholz: sein Schutz und seine Eigenschaften. **[Building timber: its protection and properties.]** Verlag August Lutzeyer, Leipzig. 1943. pp. 142. [G.] P.R. Price RM 4.50.

An account of the state of timber supplies in Europe in 1943. Describes the most important fungi which attack structural timbers and discusses (*a*) methods and preservatives used for protecting timber against attack by fungus, insects and fire; (*b*) the mechanical properties of wood with the formulae and tests used, and gives specifications for various quality classes of timber. Includes a section on the cooling and specific heat of dry and moist timbers [see *For. Abstr.* 5 (35)] and 99 illustrations, consisting of photographs, graphs and diagrams.

[1775]. 33.4 : 12.26–8 (481). KIERULF, T. Om utnyttelse av løvskogen til parkettstav. **[The utilization of hardwoods for parquet flooring.]** *Tidsskr. Skogbr.* 52 (11/12), 1944 (200–5). [Nor.]

Discusses the use made of Norwegian-grown Oak, Birch and Common Alder and the possibility of growing Oak specifically for parquet.

[1776]. 33.4 : 31.27. SEILER, J. F. **Wood beams reinforced for horizontal shear.** *Timber News* 55 (2098), 1947 (283–5).

Tests at the University of West Virginia show that dowels driven into lead holes of appropriate size can increase the resistance to horizontal shear. Results indicate that deep beams may be built up of shallow sections dowelled together, and the shear strength of beams weakened by checking may be restored by dowelling.

33.5. *Pitprops. Sleepers. Poles and Other Roughly Converted Wood*

See also *For. Abstr.* 9
(Nos. 1741, 1749–50, 1758–63, 1793).

[1777]. 33.51 (748). FERREE, M. J. **Timber requirements of anthracite mines.** *Sta. Note Ntheast. For. Exp. Sta.* No. 4, 1947. pp. 3.

The amount of timber needed for each ton of coal mined in Pennsylvania rose from 0·61 cu. ft. in 1923 to 0·97 in 1943 and is steadily increasing.

33.6. *Packing Boxes, Crates, etc.*

[1778]. 33.6. SOULE, S. P. **Apple scald and its relation to Pacific Northwest forest species used to package fruit.** *Res. Rep. Wood. Box Inst., S. Francisco* No. 1, 1947. pp. 8. P.R.

Observations of varieties of apple in contact with various conifer woods under different

moisture conditions indicate that apple scald is not caused by the species of wood used in packing.

[1779]. 33.6 : 12.26–8. SANDS, W. **Aspen [*Populus tremuloides*] for containers.** *Lake St. Aspen Rep.* No. 10, 1947. pp. 12.

[1780]. 33.6 : 12.25 : 33.36.1. MOORE, W. C., and BRYAN, J. **Preserving boxes used in horticulture.** *J. R. hort. Soc.* 71 (3), 1946 (79–84). O.B.D.

Experiments in the preservative treatment of boxes used for horticulture are detailed. Boxes of Western Red Cedar (*Thuja plicata*) were greatly superior to those of *Pinus sylvestris* and needed no preservative treatment. Copper-naphthenate solution was the most successful preservative used for boxes of *Pinus sylvestris*; it can be applied by a dip treatment. The use of galvanized nails is recommended.

[1781]. 33.6 : 33.15.3. FINLEY, T. M. **Gasoline-resistant wood filler.** *U.S. Patent* No. 2,410,645, Nov. 5, 1946. *Chem. Abstr.* 41, 1947 (586). P.R.

Wooden containers are made impervious to organic liquids and to gasoline by hot impregnation with a soap filler consisting of 128 parts by weight of lard, 24 parts concentrated lye, 5 parts MeOH, 21 parts glycerol and 4 parts gasoline. The exterior surface is then cleaned, and painted with three coats of synthetic enamel.

33.8. *Other Manufactured Products*

See also *For. Abstr.* 9 (Nos. 1679, 1689, 1748).

[1782]. 33.8 (94) : 31.22.1. GREENHILL, W. L. **Temperatures and moisture contents attained by wooden aircraft in service in Australia.** *Rep. Aust. Coun. Aeronaut.* No. ACA–23, 1946. pp. 64. P.R.

Discusses and tabulates results of tests to determine variations in temperature and moisture contents in Anson and Mosquito aircraft by means of ground and flight tests, with data on the effect of various surface finishes. Describes laboratory tests reproducing the loosening of screws and brads in aircraft wings, the behaviour of different types, and the effect of periodically tightening them, and suggests remedies.

[1783]. 33.8 : 33.15.2 (431–5). APPLEYARD, D. C. **Structural work at Focke-Wulf, Bad Eilson.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 285, Item No. 25 [*n.d.*]. pp. 12. P.R.

Includes a section on the use of laminated wood in the aircraft T.A.154.

[1784]. 33.8 (431–5) : 33.15 : 33.32.4. HARRIS, L. M., and GREY, J. T. **Plastic and wood for aircraft tooling and fabrication.** *FIAT Final Rep. Brit. Intell. Obj. Sub-comm.* No. 446, 1946. pp. 34. P.R.

Describes glues, resins and plastic products made by Chemischer Werke Albert, Dyamit A.G., I.G. Farben and Otto Bosse for aircraft uses, including production methods, properties, and uses of the improved woods Pressholz and Oboholz, a wood plastic Tronal and the wood-bonding glues Kaurit W, Kaurit W.H.K., and C.S.593. Also describes and illustrates the plastic sections made of Dynal, a plastic-impregnated paper-pulp product, and Tronal, in the F.W.190 fuselage.

[1785]. 33.8 : 33.15.2 : 31.27. LUXFORD, R. F., and KRONE, R. H. **Laminated Oak frames for a 50-foot navy motor launch compared to steam-bent frames.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1611, 1946. pp. 11 + tbls. + figs. P.R.

Describes tests of the relative merits of steam-bent and laminated frames based on the pattern for frames of a 50-ft. motor launch. Tests were made by transverse and end thrust loading. They show that steam-bent frames are excelled in bending strength and stiffness by laminated frames of similar cross section, and equalled by those $\frac{7}{8}$ as large in each cross-sectional dimension. Steam-bent frames can be deflected much further under a contrary straightening force which straightens out or reverses the original bend and will absorb several times as much energy as a laminated frame before breaking under a force or blow applied to the outside of a boat between the keel and gunwale. [Cf. *For. Abstr.* 9 (No. 1171).]

[1786]. 33.8 : 33.15.2. SILVESTER, F. D. **An experiment with plywood.** *Quart. Rev. Timb. Developm. Ass., Lond.* 2 (1), 1947 (15). P.R.

Describes 2 types of plywood grain bin, one circular, 10 ft. in diameter and 4 ft. high, one square with sides 8 ft. long × 4 ft. high,

designed by the Ministry of Agriculture and Fisheries and used experimentally in the Midlands and Southern England for 3 years. Grain used in testing the bins stored satisfactorily and the bins after three years' exposure showed no sign of rot or attack by fungi or vermin.

[1787]. 33.8 : 33.15.2 : 33.15.1. **Laminated shafts.** *Wood* 9 (12), 1947 (244–7).

Account, with illustrations, of the manufacture and use of laminated shafts for milk carts. It has been found that the cost of laminated shafts is about the same as that of solid Ash shafts, but that they are lighter, more resilient and tougher.

[1788]. 33.8. NICHOLS, C. R. **The manufacture of wood-cased pencils.** *Pap. Amer. Soc. mech. Engrs.* No. 46–A–4, 1946. pp. 5. P.R.

33.9. *Grading [including Standard Specifications] and Storage of Converted Timber*

[1789]. 33.91 : 33.36.3 (68). **Standard specification for dry or seasoned timber.** *S. Afr. Stand.* S.A. No. 15, 1942. pp. 8. P.R.

Gives permissible moisture content (expressed in percentage of dry weight of wood) for various purposes, and methods of testing it.

[1790]. 33.91 : 33.4 (44). VÉDRENNE, J. La normalisation dans la menuiserie. [**Standardization in joinery.**] *Rev. Bois Appl.* 2 (6), 1947 (13–16). P.R.

Discusses the need for increased standardization in order to economize materials, and considers proposed standards for outer and inner doors.

[1791]. 33.91 : 33.4 (410). **British standard specification for double-hung sashes with cased and solid frames.** *Brit. Stand.* No. 644: Part 2: 1946. pp. 21. P.R.

[1792]. 33.91 : 33.4 : 12.25 (73). **Standard stock Ponderosa Pine doors.** *Comm. Stand. U.S. Bur. Stand.* No. CS120–46, 1946. pp. 40. P.R.

Illustrated specifications for different types of doors by sizes, construction and grades, with Government grade markings and a classification index.

[1793]. 33.91 : 33.54 (410). **British standard specification for clothes-line posts (concrete, steel and timber).** *Brit. Stand.* No. 1373, 1947. P.R.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

[1794]. 34 (548). RAMASWAMY, M. N. **Minor forest products in Mysore. A survey.** Govt. Press, Bangalore. 1945. pp. 64.

Examines the actual and potential utilization in Mysore of minor forest products, i.e. products other than timber, fuel and fodder. Among the more important articles are Sandalwood, tanstuffs (especially *Cassia auriculata*) and lac. Recommendations are made for increased research into and organization of this important side of forestry in Mysore.

34.2. *Vegetable Products*

[1795]. 34.2 (81) : 33 : 35 : 98.1 : 09.4 : 09.7 : 81. SOUZA, P. F. DE. Tecnologia de produtos florestais. [**Technology of forest products.**] Imprensa Nacional, Rio de Janeiro. 1947. pp. 409. [Port.] P.R.

A comprehensive work summarizing technical knowledge in the field of some of the most important forest-products industries. It opens with a discussion of the world timber trade, giving figures for imports and exports between 1928 and 1936, a summary of the history of the Brazilian forest service and a short description of the forests. The Brazilian timber industry is briefly reviewed with details of exports between approximately 1900 and 1944. Chapters under the following heads form the main body of the book:—Fuelwood, sleepers, posts, charcoal, wood distillation, Rosewood oil, Quebracho, resin, Maté, cork, Brazil nuts, rubber, pulp and paper. Each includes a historical summary of the industry, relevant technical information and a description of the Brazilian industry with details of production, consumption, exports and imports.

34.21. Forest Litter

[1796]. 34.21 : 11.44. RAGHAVAN, M. S. **Manuring: the evil effects of utilization of dry leaves from forests.** *Indian For.* 73 (8),

1947 (345–50). (7th All-India Silvicultural Conference (1946), Dehra Dun).

The author gives an account of European research on the effects of litter removal, compares Indian conditions, and finally condemns any removal of litter from forests, especially in arid and semi-arid areas.

34.24. Tanning Materials. Cork. Bark Products

See also *For. Abstr.* 9 (No. 1811).

[1797]. 34.24. BEEBE, C. W., CORDON, T. C., and ROGERS, J. S. **Extraction of tannin by centrifugal filtration.** *J. Amer. Leath. Chem. Ass.* 41 (4), 1946 (161–71). L.S.

A method devised for the efficient extraction of tannin from Canaigre [*Rumex hymenosepalus*] was applied with success to barks of *Tsuga canadensis*, *Quercus laevis*, *Pinus longifolia* and *Lithocarpus densiflorus*. After grinding to pass a 1-mm. screen, or crushing between rollers set at 0·635 mm. for the barks and 0·127 mm. for Canaigre, the mixture was stirred vigorously for ½ hr. and the liquors separated by filtering or centrifuging. This method produced as much or more tannin from crushed bark and more tannin from powdered bark than do the usual leaching methods.

[1798]. 34.24 : 12.25 (498). RAȘCANU, R. Exploatorea coajei de molid. [**Exploitation of Spruce bark.**] *Rev. Pădurilor* 56 (3/6), 1944 (104–8). [Rum.f.]

Data on the Rumanian industry, including season of exploitation; tools employed; harvesting, drying and transport of the bark; production per woodman; and grading.

[1799]. 34.24 : 12.26–8 (81). PRIMO, B. L. **Tannin content of some Brazilian plant products.** *An. Ass. quím. Brasil* 4, 1945 (117–20). *Brit. Abstr.* BII 1946 (267). P.R.

The soluble extract and tannin content are given for the bark of *Stryphnodendron barbatimão* (30·9 per cent., 22·6 per cent.), *Piptadenia rigida* (25·5, 15·0), *Acacia decurrens* (var. *mollissima*) (40·9, 32·3), *Piper aduncum* (17·5, 9·47), *Schinus terebinthifolius* (22·9, 8·8), *Croton floribundus* (16·5, 7·7), *Rapanea ferruginea* (19.3, 10.8), *Psidium guajava* (25.4, 15.5), *Hymenaea stilbocarpa* (33·6, 19·1), *Rhizophora mangle* (32·1, 14·8), *Byrsonima verbascifolia* (27·7, 20·3), *Caesalpinia ferrea* (35·9, 10·6), and *C. tinctoria* (22·1, 14·8). Tannin content does not vary appreciably with age.

[1800]. 34.24 : 12.26–8 (729.2). MAJOR, F., and PEARMAN, R. W. **Wattle bark from Jamaica.** *Bull. imp. Inst., Lond.* 45 (1), 1947 (12–15).

Wattle (*Acacia decurrens* and *A. decurrens* var. *mollissima*) has been suggested as a possible alternative crop to Coffee on steep eroded slopes in Jamaica. Samples of bark from both varieties, grown in Jamaica, were examined, and the results of the examination are given together with the chemical analysis. It is concluded that, with more careful drying, Wattle barks similar to the samples would probably furnish lighter-coloured extracts which would still contain very satisfactory amounts of tannin, particularly in the case of Black Wattle (*A. decurrens* var. *mollissima*).

[1801]. 34.24 : 12.26–8 (759). CALDERWOOD, H. N., and MAY, W. D. **Florida scrub Oak—new source of vegetable tannin. (An alternative to the Chestnut extract problem.)** *Tech. Pap. Fla. Engng. industr. Exp. Sta.* No. 10, 1946. pp. 3. *Repr.* from *Hide and Leather and Shoes* June 8, 1946.

A process has been developed for obtaining bark from Florida scrub Oaks which are too small and crooked to be peeled by the usual methods. The entire tree, including small limbs, is comminuted in the woods by a small portable chipper, and the chips, after being sorted into sizes on a set of mechanically driven screens, are fractionated into bark and wood by a commercial machine widely used for refining various materials. Both the bark and the wood particles are obtained in a high state of purity and the bark, after controlled dehydration with heat, is sent to the tanning-extract plant for leaching.

[1802]. 34.24 : 12.26–8 (759). CALDERWOOD, H. N., and MAY, W. D. **Scrub Oak as a potential replacement for Chestnut.** *Tech. Pap. Fla. Engng. industr. Exp. Sta.* No. 15, 1947. pp. [19]. *Repr.* from *J. Amer. Leath. Chem. Ass.* 17 (2), 1947 (62–80).

Three species of Oak, *Quercus cinerea*, *Q. laevis* and *Q. marilandica*, growing in Florida, have been studied with reference to:—(1) growth characteristics after the sprout or seedling stage; (2) size of these species in areas

where they are the dominant vegetation; (3) number of trees per acre on land where they are the dominant species; (4) relative proportion of bark and wood that can be obtained from them. A mechanical method has been developed for obtaining bark from trees too small for peeling [see preceding abstract]. Sale of wood (possibly for pulp) after removal of bark is necessary for a successful commercial operation. *From authors' summary.*

[1803]. 34.24 : 12.26–8 (73). COOKE, G. B. **Progress in cork culture in the United States.** *Sci. Mon., Wash.* 64 (2), 1947 (117–22). P.R.

[1804]. 34.24 : 12.26–8 : 12.11.11. PARIHAR, D. B., and DUTT, S. **Chemical examination of the bark of *Alangium lamarkii*. Isolation of the alkaloid alangine.** *Proc. Indian Acad. Sci.* 23A, 1946 (325–9). E.M.B.

[1805]. 34.24 : 12.26–8 : 12.11.11. CHAKRAVARTI, D., and BHAR, C. **Crystalline components of the bark of *Prunus puddum* (Roxb.), Part II. On the constitution of prunusetin.** *J. Indian chem. Soc.* 22 (10), 1945 (301–4). [University College of Science and Technology, Calcutta.] L.S.

Cf. *For. Abstr.* 7 (No. 587).

34.25. Medicinal and Edible Plants

[1806]. 34.25 : 12.26–8 : 12.11.11. HARPER, S. H., POTTER, C., and GILLHAM, E. M. ***Annona* species as insecticides.** *Ann. appl. Biol.* 34 (1), 1947 (104–12). O.R.E.

By extraction and precipitation from several solvents the toxic principle present in *Annona reticulata* and *A. squamosa* seeds and roots was concentrated one hundredfold. A preliminary chemical examination is described. Toxicity is due to a glyceride or glycerides of a hydroxylated unsaturated acid or acids of high molecular weight. The extracts were examined for insecticidal properties and compared for their contact-insecticidal properties with those of rotenone. When used as a contact insecticide against *Aphis fabae*, *Macrosiphoniella sanborni* and *Macrosiphum solanifolii* the concentration had a toxicity comparable with rotenone, but was less effective against *Oryzaephilus surinamensis*. As a stomach poison the ether extract proved both toxic and repellent to *Plutella maculipennis* larvae, but was neither to *Diataraxia oleracea* larvae. The potency of the concentration is limited therefore and although roughly of the same order as that of rotenone to certain aphids, has neither the intensity nor range of action of that compound. *From authors' summary.*

[1807]. 34.25 : 12.26–8 : 12.11.11. RANGASWAMI, S., RAO, K. V., and SESHADRI, T. R. **Kanugin, a crystalline component of the roots of *Pongamia glabra*.** *Proc. Indian Acad. Sci.* 16A (5), 1942 (319–22). O.R.S.

A crystalline compound melting at 197–8° F. and having the molecular formula $C_{19}H_{18}O_7$ has been isolated from the roots of *Pongamia glabra*. It has been named kanugin. It is a neutral body having three methoxyl groups and it differs in its properties from karanjin, pongamol and rotenone. *Authors' summary.*

[1808]. 34.25 : 12.26–8 : 12.11.11. RANGASWAMI, S., and SESHADRI, T. R. **Constitution of kanugin. Part I.** *Proc. Indian Acad. Sci.* 17A (1), 1943 (20–5). O.R.S.

An analysis of the crystalline component of the roots of *Pongamia glabra*.

[1809]. 34.25 : 12.26–8 : 12.11.11. RAJAGOPALAN, S., RANGASWAMI, S., RAO, K. V., and SESHADRI, T. R. **Constitution of kanugin. Part II.** *Proc. Indian Acad. Sci.* 23A (2), 1946 (60–6). O.R.S.

[1810]. 34.25 : 12.26–8 : 12.11.11. RANGASWAMI, S. **Occurrence of kanugin in the stem bark of *Pongamia glabra*.** *Curr. Sci.* (5), 1946 (127–8). L.S.

An analysis of the crystalline component of the stem bark of *Pongamia glabra* identified it as kanugin. Stem bark gives a lower yield of kanugin than the root bark.

[1811]. 34.25 : 12.26–8 (711). **Restrict harvesting of Cascara bark.** *Timber of Canada* 7 (12), 1947 (17).

Regulations have been issued by the British Columbia Government, placing a limit on the gathering of Cascara [*Rhamnus purshiana*] bark [cf. *For. Abstr.* 7 (1966)]. It must not be harvested on privately owned or leased land without the written consent of the private owner or lessee; nor from Crown lands without a permit from the forest service. Permits shall be subject to the following conditions:—(*a*) All

trees must be felled before peeling; (*b*) no tree under 4 in. stump diameter 6 in. above the ground can be cut; (*c*) at least 6 in. of stump must be left and the stump must not be peeled; (*d*) all limbs and branches must be peeled down to a diameter of at least 1½ in.; (*e*) every precaution must be taken to prevent injury to small sprouts growing below the stump line. The amount of bark harvested annually from Crown lands under permit must be reported to the forest service.

[1812]. 34.25 (576) : 12.11.11. ZEPKOVA, G. A. **Concentration of vitamin C in certain plant species of central Asia.** *C.R. (Doklady) Acad. Sci. U.R.S.S.* 48 (9), 1945 (655–8). [E.] O.R.S.

The tables of vitamin C content in the leaves of various plants include the following woody species:—*Sorbus persica, Robinia pseudoacacia, Pyrus communis, Cercis siliquastrum, Acer negundo, Acer pseudoplatanus, Juglans regia, Gleditsia triacanthos, Malus pumila, Prunus armeniaca, Crataegus* spp.

34.26. Resin. Turpentine. Oils

[1813]. 34.26 : 12.25. POVARNIN, I. G., and PALEEVA, G. P. **Oxidation of conifer resins and rosin.** *U.S.S.R. Patent* No. 66,876, Aug. 31, 1946. *Chem. Abstr.* 41, 1947 (4658). P.R.

Resin or rosin is emulsified with aqueous alkali and treated with air at 30–100° C. The oxidation product is treated with a dilute acid, washed and dried. Resins thus treated give light surface coatings.

[1814]. 34.26 : 12.25 : 12.11.11. MIROV, N. T. **Composition of gum turpentine of Bishop Pine.** *J. For.* 45 (9), 1947 (659–60).

The turpentine obtained from Bishop Pine [*Pinus muricata*] oleoresin consisted chiefly of d-α-pinene (98–99 per cent.), with a small admixture (less than 1 per cent.) of camphene. *From author's summary.*

[1815]. 34.26 : 12.25 (471). GREKHNEV, M. A. Efirnȳe masla pikhtȳ i vozmozhnost' ikh promȳshlennogo polucheniya v Komi ASSR. [**Essential oils of Silver Fir and the possibilities of industrial production in the Komi A.S.S.R.**] *Lesnaya Prom.* 1947 (2), (15–17). [Russ.]

Laboratory experiments on the yield of essential oil from steam distillation of Silver Fir [*Abies sibirica*?] twigs and foliage from the Komi A.S.S.R. indicated that: (1) Material from trees growing on clayey alluvial silt gave a yield considerably greater than that from trees on loamy sand. (2) At the end of July the yield was about 26 per cent. greater than in mid-June. (3) Pre-drying the material at 42–43° C. increased the yield by about 17 per cent. as compared with undried controls. This increase took place only for the first 26 hours of drying, the yields after drying for 26, 47 and 71 hours being constant. Data for drying at 32–33° gave no positive result, possibly because the period of drying was too short.

In W. Siberia, where foliage and twigs were stored in the sun or shade in the open (at temperatures probably between 30° and 50°) the maximum essential-oil content was reached after 15 days. After 30 days' storage the oil content began to decrease, and after 60 days it dropped below that of the material before storage. These results contradict the opinion that the material will keep only for 3–5 days, and storage should be a much simpler matter than has often been supposed. (4) The yields of essential oil from various parts of the tree, in percentage of the oven-dry weight of the raw material, were: twigs plus foliage 3·09, foliage alone 3·27, branch bark 3·03, and stem bark 2·81. These yields are equal to those from Silver Fir in other parts of the U.S.S.R. and indicate the possibility of using bark as well as foliage and twigs for industrial production. (5) The bornyl-acetate content of the oil is about 40 per cent. and the oil is thus quite suitable for the manufacture of synthetic camphor.

[1816]. 34.26 : 12.26–8 (560). OKAY, M. I., and GÜRGEN, A. R. [**An investigation on Eucalyptus oils in Turkey.**] *Derg. Yüksek Ziraat Enst.* 5, 1945 (127–47). [Turk.] *Chem. Abstr.* 41, 1947 (1391). P.R.

Dry leaves of *Eucalyptus globulus* (I), *E. amygdalina* (II), and *E. rostrata* (III) were analysed for their essential oils. The yield of oil was 2·6, 0·7, and 0·6 per cent. of oil respectively. The densities were 0·9304, 0·8972, and 0·911 respectively. While 79 per cent. of the oil of I could be distilled off at 165–183° C., the oils of II and III furnished only 36·2 and 33·8 per cent. of distillate. The bulk of their oils

boiled above 183°. The *n*s of the three oils were 1·466, 1·500, and 1·490, the content of cineol 70 and 7 per cent. in the oils from I and II respectively. While the oil from II had a pleasant perfume, that of I and III had an irritating odour causing coughing.

[1817]. 34.26 : 12.26–8. PENFOLD, A. R., and MORRISON, F. R. **Australian Tea trees of economic value. Part I.** [*Melaleuca linariifolia* **and** *alternifolia*]. *Bull. Technol. Mus., Sydney* 3rd ed. (revised), 1946. pp. 16.

[1818]. 34.26 : 12.26–8. BERKEL, A., and HUS, S. [**The Amber-tree woods and investigations on the Amber resin.**] *Derg. Yüksek Ziraat Enst.* 3, 1944 (9–28). [Turk.] *Chem. Abstr.* 41, 1947 (1466). P.R.

An analysis of the resinous oil of *Liquidambar orientalis*.

[1819]. 34.26 : 12.26–8 : 34.27 : 12.11.11. SUKUMARAN KARTHA, A. R., VENKITASUBRAMANIAN, T. A., and MENON, K. N. **The glyceride composition of fats and oils. Part II. The fatty acids and glycerides of *Terminalia belerica* (Roxb.).** *Proc. Indian Acad. Sci.* 23A (5), 1946 (283–7). O.R.S.

[1820]. 34.26 : 12.26–8 : 12.11.3. WEBSTER, C. C. **Notes on some clones of budded Tung (*Aleurites montana*).** *Nyasald. agric. quart. J.* 6 (4), 1946 (73–9). D.S.I.R.

Describes characteristics of 5-year-old clones at the Tung Experimental Station in Nyasaland, classifying them into 2 main groups. Type A are tall open trees making vigorous growth and type B, low dense bushy trees, less vigorous and more precocious in bearing. [Cf. *For. Abstr.* 7 (No. 1969).]

[1821]. 34.26 : 12.26–8. HAMILTON, J., and GILBERT, S. **Rapid method for determining oil content of Tung kernels.** *Anal. Chem.* 19 (7), 1947 (453–6). P.R.

A sample of flaked or ground kernels is dispersed in a Waring Blendor disintegrator with a commercial hexane solvent. The resulting solution is separated from the kernel residue by allowing the sediment to settle in a volumetric flask. A sample of the oil is weighed after evaporation of the solvent and the percentage calculated on the basis of the total volume occupied by sediment and solution. It is possible to attain a degree of precision indicated by standard deviations of 0·10 to 0·20 in percentage of oil content.

[1822]. 34.26 : 12.26–8. GUNSTONE, F. D., and HILDITCH, T. P. **The component acids and glycerides of Australian Lumbang oil.** *J. Soc. chem. Ind., Lond.* 66 (7), 1947 (205–8). P.R.

A sample of nuts of the Lumbang or Candlenut (*Aleurites moluccana*) tree from North Queensland contained kernels yielding 62 per cent. of a very pale-coloured oil, iodine value 164·3, and with extremely low free fatty acid content (0·3 per cent. as oleic acid). The component acids of the oil are palmitic 5·5, stearic 6·7, arachidic 0·3, oleic 10·5, linoleic 48·5, and linolenic 28·5 per cent. (wt.). The component glycerides include about 32 per cent. which contain three linoleic or linolenic radicals, and 53 per cent. with two of these groups, the third acyl group being oleic or saturated; one, and to a small extent, two, linolenic groups are probably present in all these mixed glycerides, totalling 85 per cent. of the fat. Attempts to prepare a highly unsaturated concentrate from the oil by crystallization from solvents at low temperatures were not very promising, although 66 per cent. of the oil was so obtained from acetone at −35°, with an iodine value of 179. The component acids and constituent glycerides of this fraction differed, however, very widely from those of linseed oil. Although differing in composition from linseed oil, Lumbang oil of the high quality represented by the specimens studied should have considerable uses as a 'drying' oil. *Authors' summary.*

34.27. Seeds. Fruits. Leaf Fodder. Fibres and Flosses

See also *For. Abstr.* 9 (No. 1463).

[1823]. 34.27 : 12.26–8 : 34.25 : 21. BEIJERINK, W. Enkele gegevens betreffende hazelaars en de hazelnotenteelt. [**Notes on Hazels and Hazelnut growing.**] *Ned. Boschb.-Tijdschr.* 19 (6; 7), 1947 (153–60; 189–94). [Du.]

A brief review (22 refs.) of the species, forms and cultivated strains of *Corylus*, their geographical range and habitat requirements, propagation, ornamental varieties, commercial nut-growing (with special reference to Great Britain and the U.S.A.), and the food value of the nuts.

[1824]. 34.27 : 12.26–8 : 12.11.11. EEKELEN, M. VAN, and LAAN, P. J. VAN DER. **The toxicity of Beechnuts and Beechnut flour.** *Voeding* No. 4, 1945. pp. 11. *Chem. Abstr.* 40, 1946 (6179–80). P.R.

An account of experiments to identify the toxic ingredient in Beechnuts.

[1825]. 34.27 : 12.26–8 : 12.11.11. BHALERAO, V. R., and DASTUR, N. N. **Composition of 'Rain tree' fruits.** *Curr. Sci.* 15 (9), 1946 (251). [Imperial Dairy Research Institute, Bangalore.] L.S.

A chemical analysis of kernels, seeds, and whole pods of *Pithecellobium saman*. The pods are a good source of proteins, carbohydrates and minerals, forming a valuable cattle food. Between March and May, moisture content of the whole fruit decreases from 20 to 12 per cent. and other constituents show a corresponding increase.

[1826]. 34.27. **The use and misuse of shrubs and trees as fodder, with tables showing composition and digestibility.** *Jt. Publ. imp. agric. Bur.* No. 10, 1947. pp. 231 + xxxiv. Price 9*s*.

In many parts of the world, tree and shrub associations provide the bulk of the fodder required by certain domestic animals, while in an even wider area they are regarded as a fodder reserve for periods of drought and shortage of fodder from more usual sources. This publication is a review of the present state of knowledge and experience on the subject with the emphasis primarily on the function of these associations as protectors of the soil in critical environments. Once this requirement has been met, it is possible to consider the alternative use of trees and shrubs and whether their utilization as fodder is desirable from all points of view. These questions are considered as they apply to U.S.A., Canada, Australia, New Zealand, South Africa, Africa other than the Union, India, Russia and elsewhere. There are illustrations showing the species and associations and the degree of damage caused by browsing and lopping. Data for the composition and nutritive value of trees and shrubs are tabulated, with notes on their use as fodder.

[1827]. 34.27 : 12.25 : 33.32.3. BOSSCHART, R. A. J. **Woodlike pressed material from conifer needles.** *Dutch Patent* No. 57,426, May 15, 1946. *Chem. Abstr.* 41, 1947 (4628). P.R.

Pine needles are milled and parts over 2 mm. and under 0·5 mm. sifted off. The mass is given a 14-per-cent. H_2O content and pressed at 120° C. and 125 kg./sq. cm., giving a woodlike or, at 50 kg./sq. cm., a cork-like material. Filling, softeners and colouring material may be added.

[1828]. 34.27 : 12.29 (81). BAYMA, C. **Buriti.** *Rev. flor., Rio de J.* 5 (2), 1946 (24 + plate). [Port.]

In addition to the known products of the South American Palms Buriti (*Mauritia vinifera*) and Miriti (*M. flexuosa*), the long and extremely light leafstalks are suitable for use as an insulating material and could replace substances such as 'Insulite' and 'Celo-Tex' which are now imported into Brazil. The best and most easily exploited stands of *M. vinifera* are found in the Parnahyba river valley, whose waterways carry a constant stream of rafts made from Buriti leafstalk fibre down to the port of Amarracão and the capital of Piauhy province. These rafts are abandoned after their cargoes are discharged. The author states that 3,000 tons of this wasted Buriti fibre would make 1,000 cu.m. of 'Palm-Tex' insulating material.

34.28. Osiers, etc.

[1829]. 34.28 : 12.26–8 (470). NEKRASOVA, V. L. Pletenye zhilishcha. **[Wattle constructions [wickerwork, etc.].]** *Priroda, Moskva* 34 (6), 1946 (44–9). [Russ.] C.G.B.

An annotated list of trees and shrubs in the U.S.S.R. that are suitable for wickerwork and wattle constructions, e.g. houses, sheds, fences, baskets, mats. The species dealt with are Osiers [*Salix* spp.], *Carpinus orientalis*, *Corylus avellana*, *Prunus padus*, *Quercus robur*, *Betula pubescens*, *Populus tremula*, *P. nigra*, *Caragana arborescens*, *Parrotia persica*, *Cornus sanguinea*, *Rhododendron ponticum* and *Tilia cordata* (the last-named for bast products such as mats). A supplementary list of herbaceous species for allied purposes is also included.

34.3. *Products of the Animal Kingdom*

[1830]. 34.3 : 13.2 : 32.92. OSTROUMOV, N. A. **The influence of timber drift upon**

fishery resources in northern plain rivers. *C.R. (Doklady) Acad. Sci. U.R.S.S.* 56 (1), 1947 (87–9). [E.] O.R.S.

Investigations in the rivers Dvina, Vychegda, Sysola and part of the Pechora indicate that: (1) the river-beds consist mainly of sand and gravel, higher water-plants are rare and only the wood-waste carries any form of animal life (larvae of *Trichoptera, Ephemeridae, Tendipedidae*), (2) the extraction of toxic substances from bark and wood is slow, and they are rapidly diluted, (3) timber-waste in moving water increases, and in stagnant decreases, the biomass and (4) after 20 years of timber-floating no decrease in number of fish is noticeable.

35. SALE AND DISPOSAL OF FOREST PRODUCTS. TIMBER TRADE

See also *For. Abstr.* 9 (Nos. 1629, 1962–5, 1973–4).

[1831]. 35 (437) : 98.3 : 09.4. Vývoz a dovoz dříví r. 1937 a 1946. **[Wood exports and imports [of Czechoslovakia] in 1937 and 1946** [illustrated with graphs and tables].] *Lesn. Práce* 26 (6), 1947 (202–10). [Cz.]

[1832]. 35 (71) : 98.3. ROCHESTER, G. H. **The Canadian export picture.** *Timber of Canada* 8 (1), 1947 (55, 98, 100, 102).

An analysis of Canadian timber exports from 1924 to 1944.

[1833]. 35 (756) : 09.7. WACKERMANN, A. E. **Forest products marketing problems in the Piedmont region of North Carolina.** *Bull. Duke Sch. For.* No. 12, 1945. pp. 61. P.R.

[1834]. 35 (81) : 12.25 : 12.25–8 : 98.3 : 09.4. Exportação de pinho em 1946. Exportação de outras madeiras em 1946. **[Export of Pine and other timbers [from Brazil] in 1946.]** *Brasil madeireiro* 3 (26), 1947 (39). [Port.]

Figures for export of various categories of wood products from Brazilian states to domestic and foreign markets. [Cf. *For. Abstr.* 9 (No. 1795).]

[1835]. 35 (81) : 12.25 : 98.1 : 09.4. Produção de pinho serrado em 1945–1946. Produção de pinho beneficiado em 1945–1946. Produção de outras madeiras serradas em 1945–1946. Produção de outras madeiras beneficiadas em 1945–1946. **[Production of Pine and other timbers, both sawn and further converted for 1945 and 1946.]** *Brasil madeireiro* 3 (26), 1947 (37–8). [Port.]

A series of tables giving statistics for Brazilian production by states, showing the local consumption and export, with main categories of converted produce.

38. CONSTRUCTIONAL WORKS. ENGINEERING

38.2. *Building Construction. Foundations and Superstructures*

See also *For. Abstr.* 9 (No. 1612).

[1836]. 38.2 (4) : 38.3 : 33.15.2 : 31.27. STERN, E. G. **Modern timber construction in Europe.** *Bull. Va. Polyt. Inst.* 40 (1), 1946. pp. 24. P.R.

Reviews Swiss tests of nailed joints, and tests and use in building of laminated constructions using cold- and hot-setting urea-formaldehyde resin glues, Melocol H & M. Describes types of wood-arch falsework for 6 reinforced concrete bridges in European countries.

[1837]. 38.2 (4) : 33.4 : 33.32.3. STERN, G. E. **European developments in timber design and construction.** [Department of Wood Construction, Virginia Polytechnic Institute.] 1947. pp. 9. P.R.

Summarizes European literature on the development of the 'Durisol' construction system using cement-bonded wood-fibre panels; saw-tooth timber splicing by high-frequency heat application; investigations on nailed timber joints; studies of timber-connector joint efficiency; wood beams and floors of composite constructions; nailed wood frame constructions; standard timber-girder bridge units; timber falsework; wood subflooring for highway bridges. *From author's summary.*

[1838]. 38.2 (494) CAMPREDON, J. Techniques modernes en Suisse. Les charpentes collées. **[Modern methods in Switzerland. Glued framework.]** *Rev. Bois Appl.* 2 (2), 1947 (3–6). P.R.

Describes briefly, with illustrations, examples of the use of laminated and jointed timber frameworks.

[1839]. 38.2 (44) : 33.32.3. RIMASSON, L. Les maisons préfabriquées à base de bois.

[Prefabricated houses of wood-base materials.] *Rev. Bois Appl.* 2 (6), 1947 (17–21).

Discusses types of prefabricated houses from various countries and gives a detailed description with ground plans and elevations of French designs for 5- and 6-person chalet-type houses. These have a wooden framework supporting the roof. The outer walls are panels fitted into the framework, the outer panels being a mixture of wood-fibre and cement and the inner consisting of hardwood or softwood fibreboards. The interior walls are of fibreboard panels. The walls are hollow, giving maximum non-conductivity of heat and sound.

[1840]. 38.2. REECE, P. O. **More roofs.** *Quart. Rev. Timb. Devel. Ass.* 1 (12), 1947 (10–11).

The Timber Utilization and Construction Committee of the Timber Development Association have approved a project for building and testing an experimental gable-ended roof in which up to 80 per cent. of the rafters could be short lengths of 8–12 ft. Every fifth or sixth pair of rafters is framed and braced to the ceiling joist with 'Bulldog' connectors in the form of a truss. These trusses carry a purlin upon which the short-length rafters can be lapped and nailed. If tests on this construction are satisfactory it could well be adopted for prefabrication.

[1841]. 38.2 : 31.27. GLOSS, R. H. **Tests of eccentric split-ring joints yield rational design formula.** *Engng. News-Rec.* 138 (22), 1947 (895–6). L.S.

Tests assimilating conditions in eccentric split-ring joints indicate that ultimate load varies almost directly with the thickness and effective depth of the critical member. An empirical formula which explains the best results is the usual horizontal-shear formula modified by substituting the effective depth, as defined in the article, for the normal depth, and allowing 150 per cent. of the tabulated horizontal shear stresses. *From author's summary.*

[1842]. 38.2 : 31.27. Forsøg med Træforbindelser I. **[Experiments with wood joints.]** *Medd. Lab. Bygningsstatik, Kbh.* No. 10, 1941. pp. 77. [Dan.g.e.] *Repr.* from *Bygningsstatist. Medd.* 12 (2), 1941. P.R.

Experiments to determine the strength and stiffness of modern timber joints, consisting usually of a bolt, with a connector (claw-plate or toothed) between the faces of the joint to prevent slipping of the timbers. The function of the joint may be divided into: (1) the dowel effect of the bolt, depending on its resistance to bending and the wood's resistance to crushing, (2) the tensional effect of the bolt, depending on its resistance to tension and friction between the abutting surfaces and (3) the effect of the connector, depending on its form and strength and the resistance of the wood to crushing. Results are explained in graphs, tables and illustrations.

[1843]. 38.2 : 33.91 : 31.27. BJURSTEN, G. Normer och forskning i USA rörande spikförband. **[Standards and research on nailed joints in the U.S.A.]** *Rapp. Komm. Byggnadsforskn., Stockholm.* No. 11, 1947. pp. 41. [Sw.sw.] P.R.

Quotes American formulae, tables and graphs for permissible loads of nailed joints in relation to the dry weight of the wood and the diameter of the nail, with modifications necessitated by variations in density and moisture-content of the wood, and type of nail used. Gives graphs comparing permitted loads and holding power accepted in U.S.A., Germany and Sweden, and tabulates results of experiments with Swedish and American nails in Douglas Fir.

[1844]. 38.2 : 07.7. **Traveling scaffold 145 ft. high used in repairing timber airship hangars.** *Engng. News-Rec.* 138 (6), 1947 (76–9). D.S.I.R.

Describes with illustrations a timber scaffolding for repairing arched timber trusses in the roofs of airship hangars. The scaffold is 60 ft. square at the base, half the width of the hangar, 145 ft. high, and has 16 working platforms at the required levels on one side of the scaffolding. The 6 × 6 ft. towers at each of the 4 corners are supported on solid rubber-tyred trucks, with 12 wheels to each truck, of the type used in house moving. The scaffold is designed for a live load of 600 lb. concentrated at any point on each of the platforms plus a 10-lb. wind load; it can carry 50 men, and moves ahead 60 ft. per shift. None of the timbers used is larger than 6 × 6 in.; wire rope guys in $\frac{1}{2}$- and $\frac{3}{4}$-in. sizes are used as stays for wind bracing and for general stiffening.

[1845]. 38.2 : 82 (481). NORWAY. God tegninger for skogstuer. **[Good designs for forest cabins.]** Grøndahl & Søns Boktrykkeri, Oslo. 1946. pp. 27. [Nor.] *Suppl.* to *Tidsskr. Skogbr.* 54 (8), 1946.

A report by a committee appointed by the Norske Skogselskap on 8 designs for permanent log cabins for forest workers. The cabins are of two types, to house eight and twelve workers, and have individual and communal cooking arrangements respectively. Provision is made for tool cupboards and drying rooms in all cases. The ground plan, with the area in square metres, is given for each design, with the architect's comments. Tenders submitted for the different designs range from Kr. 4,876 to Kr. 10,196

38.3. *Road and Bridge Construction*

See *For. Abstr.* 9 (Nos. 1836–7).

38.4. *Construction of Railways, Cableways, etc.*

[1846]. 38.4 : 32.91.22 (498). RAȘCANU, R. Transportul lemnelor cu goanga. **[Transport of wood by 'goanga'.]** *Rev. Pădurilor* 57 (12), 1945 (301–6). [Rum.f.]

Describes a method of forest transport employed in the Rumanian department of Buzău. It consists of a narrow corduroy track (1·5 m. wide) to which are fixed wooden rails (0·76 m. between rails). Logs are hauled over these lines on a horse-drawn sledge. The author gives details of construction. The rails are fixed to the track by wooden pegs. A 'goanga' can be constructed on slopes varying from 0 to 14 per cent. The minimum radius of curves is 30 m. One horse can haul 3 cu.m. on each trip.

[1847]. 38.4 : 32.95. CRESTIN, F. Projet d'installation d'un télérifique. **[Plan for the installation of a cableway.]** *Rev. int. Bois* 14 (116; 117; 118), 1947 (34–41, 47; 54–60; 83–9). [F.]

Deals in considerable detail with the various problems involved in the installation of a cableway for the transport of wood, e.g. factors deciding the type of cable, tension of cable, angle of load-travel, variations in tension with changes in temperature, modification in weight or position of loads, action of the wind, changes of slope, control of moving cables, braking, and protective works.

38.5. *Construction of Hydraulic Works*

[1848]. 38.5 : 32.92. DORMIDONTOV, P. S., and POGODIN, A. YA. Ledyanŷe plotinŷ na splavnŷkh rekakh. **[Ice dams on floating streams.]** *Lesnaya Prom.* 1947 (4), (13–14). [Russ.]

In order to lengthen the period of spring flow by 3–5 days, an ice dam may be made at some narrow place, with steep banks, below a lake or depression where the water retained will freeze and, owing to its slow thawing in spring, will help to keep water levels high enough for floating.

The method of forming such a dam is as follows:—(1) When the river has frozen, a strip 3–4 m. wide is cleared of snow and a trench 4–6 cm. deep and 1–1·5 m. wide is cut in the ice. (2) By daily deepening of this trench without allowing water to enter through its bottom (wooden pegs and oakum are carried for stopping any holes accidentally made) vertical flanges of ice are formed, and in 1–2 months these reach the bottom and dam the stream. As a safety valve, a hole is kept open in the ice 15–20 m. above the intended dam. (3) In spring, or if rain is expected, the trench between the flanges is filled to the top with ice and snow, stamped firm, watered and covered with a thick layer of coniferous litter to prevent rapid thawing.

[1849]. 38.5 : 32.92 (498). ROSU, D. Grebla opritoare de la Câmpeni. **[The rafting boom at Câmpeni.]** *Rev. Pădurilor* 54 (11/12), 1947 (437–49). [Rum.f.]

Description of a wooden boom across the river at Câmpeni, for the purpose of catching timber being floated down to the sawmill at that place. The boom is destroyed almost every winter by floating ice and the author gives details of a proposed boom which could be readily dismantled for the winter.

38.6. *Drainage*

[1850]. 38.62 : 56.2 (485). BÖRJESON, P. Studier över skogsproduktion å några avdikade torvmarker, i huvudsak belägna inom Västerbottens kustland. **[Studies of increment on drained peatlands, situated mostly in the coast districts of Västerbotten.]** *Norrlands SkogsvFörb. Tidskr.* 1946 (4), (465–556). [Sw.g.]

This study is based on results from 15 sample plots established in 1925 (three areas drained between 1860 and 1890; the remainder in 1900–09) and re-measured in 1935 and 1945. The land concerned was some of the best in upper Norrland as regards suitability for drainage, all the requirements for a favourable response being present. In the period 1916–25 all plots showed a very striking rise in current annual increment. Between 1925 and 1935 there was an almost general relapse, probably due largely to neglect of drains, as no maintenance was done until 1934. In the third 10-year period increment again increased on 9 plots and decreased on 6. All the former were in places where either the drains had been cleaned over the whole area or a corresponding effect had been aimed at by deepening the main drains.

Some consideration is given to possible climatic effects during these periods, on the basis of local meteorological records plus a series of increment measurements from a single sample plot of Scots Pine and Norway Spruce on ground outside the peatland. In spite of their acknowledged inadequacy, these data suggest that 1915–25 was a good period and 1926–35 a bad one for increment, while for 1936–45 no clear correlation could be established. In the last-named it is therefore probable that the improved growth of the plots was in fact due to cleaning of the drains: in the two former periods the variations in the growth can be explained as due either to climate or to drainage conditions, but are likely to reflect the influence of both factors. [Cf. *For. Abstr.* 9 (No. 1939).]

No direct correlation was found between site quality class and the mineral nutrient content of the soil.

Notes are included on the current annual increment, height curves, bark thickness and representation by volume, of the three tree species present, viz. Scots Pine, Norway Spruce and Birch.

[1851]. 38.62 : 61.4 (485). JUNGSTEDT, B. O. Arbetsmetoder vid dikesplanläggning. **[Working methods in the planning of drainage operations.]** *Svenska SkogsvFören. Tidskr.* 45 (5), 1947 (290–306). [Sw.]

Notes on convenient procedures for making drainage maps, clearing and staking out drainage lines, description of type of land and assessment of its relative difficulty, assessment of piece-work prices for the job of drainage, survey and investigation of the ground, and grading of the drains.

4. FOREST INJURIES AND PROTECTION

[1852]. 4 (71) : 07.2. McCallum, A. W. **Forest pathology.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 934 (F–3), 1947. pp. 2.

A short account of the organization and programme of the pathological research work of the Division of Botany and Plant Pathology of the Dominion Department of Agriculture.

41. GENERAL PROTECTION AGAINST FOREST INJURIES

[1853]. 41 : 07.7 : 45.3 : 12.26–8 : 13.2. Sheals, R. A. **Airplane spraying for gypsy moth control.** *J. For.* 45 (10), 1947 (712–14). [Bureau of Entomology and Plant Quarantine, Greenfield, Mass.]

During 1946 concentrated oil solutions, ranging in strength from 6 to 12 per cent. of technical-grade DDT, were applied by aircraft at the rate of 1 gal. per acre on about 100 sq. miles of infested woodland in mountainous areas of New York and Pennsylvania. The cost of aerial spraying, including every expense incidental to the complete operation, plus 10 per cent. for overhead, was slightly less than $1.50 per acre; this could possibly be reduced. Sufficient checking has been done to indicate that complete control of the gypsy moth [*Lymantria dispar*] has been attained except in a few isolated spots. It may be significant that each area where survival was found, had been treated during the last few days of the control season, and it is possible that some caterpillars had already entered the pupal stage, against which DDT is not effective. Detailed information on construction and use of different types of distributing device can be obtained on application to the Bureau of Entomology and Plant Quarantine, 20, Sanderson Street, Greenfield, Mass. Acreage treated per machine per hour of actual flying time ranged from 82 to 176. This wide range was due partly to varying distance of air port from operational area, and partly to wide variation in carrying capacity of the different types of tank installation. In large-scale operations it is advisable to equip planes with tanks that will hold the maximum capacity approved by the Civil Aeronautics Authority. Spraying operations were always started at daybreak; the air is usually still at that time and on a normal day continues to be suitable for spraying until 8–10 a.m. Overcast days were found to be particularly favourable and allowed spraying to continue till noon or later. The 10 biplanes used during 1946 were equipped with 10 different types of distributing apparatus which developed a rather wide range of particle size of atomized spray. No significant difference was observed in effectiveness of the various particle sizes. The spinner-disk and the wing-tip types of distributing apparatus are preferred for gypsy-moth control. [Cf. also *For. Abstr.* 8 (No. 2770); 9 (No. 1910).]

[1854]. 41 : 07.7 : 13.2 (683). [Dutoit, P. J.] **D.D.T. and the aeroplane in the control of the tsetse fly and trypanosomiasis in South Africa.** *Nature, Lond.* 160 (4067), 1947 (485–6).

A large-scale experiment in tsetse-fly control by DDT has recently been completed in Zululand, where some 1,000 sq. miles of country are infested by the fly. The species concerned was *Glossina pallidipes*, a zoophilic savanna species. After unsuccessful trials of hand-spraying on the ground, experiments were made with the use of aeroplanes. A system was devised whereby tanks carrying the DDT preparation discharged into the exhaust system of the twin-engined Anson aircraft used, so that the exhaust gases gave good sublimation of active DDT in the form of dense white smoke. Flying across wind at 120 m.p.h. at a height of about 50 ft., with wind speeds of 6–10 m.p.h., an effective swathe width of 70 yds. was obtained, about 50 acres per minute being sprayed. The cost of dressing 100 sq. miles was at the rate of 2*s.* an acre for the DDT and 1*s.* an acre for the aircraft services (supplied by the S.A.A.F.). Six dressings were given, so that the total cost came to 18*s.* an acre. Up to 6 aircraft were used at a time, succeeding ones following the leader at intervals and taking their alignment at the edge of the visible spray left by the one in front. Flying so close to the ground involves some risk of accident, and it is suggested that a height of 75 ft. might be used without materially affecting the lie of the DDT. Where there were breaks in the ground because of small ravines, the spread was uneven, and DDT

grenades placed by hand were used to supplement the spraying at such places. So far, there has been no indication that there is serious danger that useful forms of life would be permanently exterminated. The spraying has resulted in a significant drop in the incidence of the tsetse flies in the area treated: the catches in the Harris traps after the spraying were exceedingly low and it is considered that with such a considerable reduction in the numbers, the ordinary causes of mortality of the tsetse fly may lead to its disappearance.

[1855]. 41 : 45.3 : 12.26–8. ROMNEY, V. E., WHITTEN, R. R., and MADDEN, A. H. **DDT wettable powders and emulsions used on American and Asiatic Elms.** *J. econ. Ent.* 40 (3), 1947 (430).

Samples of wettable DDT powders from 5 commercial producers were tested on American and Asiatic Elms in Columbus, Ohio, to determine their persistence compared with that of emulsions containing the same amount of DDT. Observations were also made on relative foliage injury. Heavy rains washed most of the deposit off the upper surface of the leaves, but that on the under-surface remained for many weeks. Foliage injury (described in some detail) from the emulsions was apparent within 24 hours and was proportional to the amount of solvent used; little or no leaf drop followed. Foliage injury from the wettable DDT powders was not apparent until after 3 weeks of exposure, was about equal to that from emulsions, but was followed by considerable leaf drop.

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42.2. *Temperature Influences. Drought*

See also *For. Abstr.* 9 (No. 1514).

[1856]. 42.21 : 12.25 : 12.14.4 : 12.14.5. GOLUBINSKI, C. C. Sluchai massovogo poyavleniya pobegov iz spyashchikh pochek u sosnȳ obȳknovennoy. **[Mass appearance of shoots from dormant buds in [seedlings of] Scots Pine.]** *Priroda, Moskva* 34 (6), 1946 (62–5). [Russ.] C.G.B.

Spot sowings of *Pinus sylvestris*, made in spring on an extensive burn in the Akmolinsk district, Kazakh S.S.R., suffered considerable damage owing to severe frost and comparative absence of snow in the following winter. In April–May of the next year about one-half of the population had completely yellowed, and had desiccated foliage and dead buds. All plots were mulched at this time with branches, bark, remains of the previous year's weeds, etc., to form a layer 2–3 cm. deep. Later, about 50 per cent. of the seedlings supposed dead produced an average of 3 shoots per seedling from dormant buds. Of a total of about 300,000 seedlings in the area, some 100,000 produced shoots in this manner.

This is the first intance known to the author of any such phenomenon in Scots Pine seedlings on any large scale.

[1857]. 42.21 : 12.26–8 (543). **[Frost in Central Provinces, India.]** *Rep. For. Res. C.P. and Berar 1945–46*, 1947 (11–12).

Very cold weather occurred during the winter of 1945–6 with temperatures as low as 28° F. Severe damage occurred in the hills even in quite dense forest.

Buchanania lanzan and *Madhuca latifolia* were severely affected and leaves up to the top of the tallest trees turned brown. Such trees produced no flowers, but new leaves came out later from buds below the damaged ends of branches. In many flat areas, trees of almost all species except *Acacia catechu* lost their leaves. Sal [*Shorea robusta*] reproduction up to about 15 ft. high was killed outright but new shoots appeared in April.

[1858]. 42.22 (498). PAVELESCU, I. M. Efectele secetei din anii 1945 şi 1946 în raza ocolului silvic experimental Carol I (Mihăeşti). **[Effects of the drought in the years 1945–6 in the Carol I experimental forest circle, Mihăesti.]** *Rev. Pădurilor* 62 (1/3), 1947 (23–7). [Rum.f.]

Rumania suffered severe drought in both 1945 and 1946, which seriously affected this forest situated in the hilly part of the department of Muscel. Considerable damage was sustained by the stands of *Quercus sessiliflora* on southern slopes, particularly those on thin soils and near hill summits. Beech, which occupies the northern slopes, suffered less. Of the conifers, Spruce and Weymouth Pine suffered most.

[1859]. 42.22 : 12.25 (945) : 45.3 : 13.2 (945). SIMS, H. J., and CARNE, R. S. **Mortality of Murray Pine stands in the Victorian**

Mallee. *Aust. J. Sci.* 9 (5), 1947 (188–9). O.B.D.

Discusses the effect of the 1943–45 drought on *Callitris robusta* in shelterbelts and timber reserves in N.W. Victoria in which attacks by buprestid beetles, *Diadoxus erythurus* and *D. scalaris* were a contributory factor. In a sample area 72 per cent. of the *Callitris* trees were dead. Stands of *Casuarina lepidophloia* and *Heterodendron oleifolium* were not affected by the drought. Rainfall figures for the 3 drought years were 1943, 939 points; 1944, 705 points; 1945, 998 points as against an average annual rainfall for 1911–42 of 1,291 points.

42.3. *Precipitations*

[1860]. 42.31 (437). SVOBODA, S. Bude špatné hospodářství s vodou příčinou zkázy vysokokmenných lužních lesů jihomoravských? **[Will bad water management destroy the lowland high forests of S. Moravia?]** *Lesn. Práce* 26 (2), 1947 (52–6). [Cz.e.]

Floods of long duration are causing considerable damage to the forests, consisting mainly of Oak, Ash and Elm, in the lower valleys of the rivers Morava and Dyje. Unless a rational system of stream regulation is developed, there will be a succession to Poplar and Willow.

[1861]. 42.31 (498). VLAD, I. Rezistența la inundații a speciilor forestiere din bazinul inferior al Ialomiței. **[Flood-resistance of forest species in the lower Ialomita valley.]** *Rev. Pădurilor* 56 (3/6), 1944 (85–93). [Rum.g.]

The author took advantage of the exceptional floods which occurred in 1940 to make observations from which he drew the following conclusions. No species can survive more than two years of waterlogging. *Salix alba* and *Fraxinus americana* can survive one year's waterlogging with only slight damage. The following species (arranged in decreasing order of resistance) may be planted on land liable to flooding: *Salix alba*, *Populus alba*, some varieties of *Populus nigra*, *Quercus robur*, *Fraxinus excelsior*, *Pinus communis*[?], *Ulmus procera*, *U. foliacea*; the last four species can stand waterlogging for only a very short period. Resistance is dependent on age, and young coppice shoots of all species are very susceptible. No relation could be observed between ruggedness of bark and resistance to waterlogging.

[1862]. 42.32 (498). NEGULESCU, V. P. Poleiul în pădurile Basarabiei. **[Glaze ice in the forests of Bessarabia.]** *Rev. Pădurilor* 55 (5/6), 1943 (222–6). [Rum.f.]

Much damage was done by glaze frost in November, 1942. Robinia suffered most severely, followed in order by Hornbeam, Ash, Maples, Poplar, Oak, Lime. Elm sustained the least damage. For the most part, stands aged 20–40 years suffered most, except in the case of Robinia, where 5- to 15-year-old stands were devastated.

42.5. *Chemical Influences. Nutrient Deficiencies*

See also *For. Abstr.* 9 (Nos. 1440, 1446–7).

[1863]. 42.5 : 12.25 : 11.42.1 (437) : 12.11.11. NĚMEC, A. Příspěvek k biochemické charakteristice odumírání jedle v polesí Chyňava na Křivoklátsku. **[Biochemical features of dying Silver Fir in the Kienau forest district in the Pürglitz region.]** *Repr.* from *Sborn. české Akad. zeměd.* 17 (3), 1942 (319–25). [Cz.g.]

Cf. *For. Abstr.* 3 (158), 8 (No. 2079). An investigation was made of the soil (derived from Algonkian clay-slate) and the chemical composition of Silver Fir [*Abies alba*] occurring as healthy 120-year-old trees and as checked and dying 30- to 50-year-old underplantings, in an old mixed stand of Oak, Scots Pine and Beech. The soil in the rooting zone of the dying trees, which extended no deeper than 35–45 cm., was very acid, had a high content of soluble Al compounds and was poor in Ca, K and Mg. It is suggested that this soil layer may have been exhausted by the preceding tree generation. Below 55 cm., soil acidity decreased, and the roots of the healthy 120-year-old trees spread into the deepest soil horizons where there were not only reductions in acidity and Al content but also far better nutrient supplies, particularly of CaO and K_2O.

Here, as in previous examples, needles of the dying trees had much lower K_2O but higher CaO, MnO and Al_2O_3 contents than those of healthy trees.

[1864]. 42.5 : 12.25 : 11.42.1 (437) : 12.11.11. NĚMEC, A. Studie o půdě a výživě chřadnoucích jedlí v oblasti algonkických břidlic na Křivoklátsku. **[Studies on soil and**

the nutrition of dying Silver Fir on Algonkian clay-slates in the Pürglitz region.] *Repr.* from *Zemédélský Archiv* 33 (5), 1942. pp. 11. [Cz.g.]

In the Bukowa district, as elsewhere, dying trees of Silver Fir were found on Ca-deficient acid soils with a high content of soluble Al compounds, whereas healthy trees occurred on very feebly acid soils with low Al and relatively high CaO contents. Needles of dying trees contained only about half as much K_2O as those of healthy ones, but more CaO, MnO, and Al_2O_3.

[1865]. 42.5 : 12.25 : 11.42.1 (437) : 12.11.11 : 11.45. NĚMEC, A. Studie o vlastnostech půdy a výživě jedle na basické vyvřelině a na algonkické břidle v oblasti křivoklátských lesů. **[Studies on soil properties and the nutrition of Silver Fir on basic eruptive rock and on Algonkian clay-slate in the Pürglitz forest region.]** *Repr.* from *Sborn. české Akad. zeměd.* 18 (1), 1943 (99–110). [Cz.g.]

Compares the chemical composition of keratophyre and Algonkian clay-slate and the soils derived from them. Keratophyre is basic, poor in SiO_2 but with considerable CaO, whereas the slate is acid and has a low CaO content. The soil over keratophyre is richer in CaO, deeper, and has a more favourable K_2O status than that over the slate.

These differences are reflected in the nutrition of two Silver Fir stands, both 80 years old, that on the former soil being healthy and that on the latter moribund. Needles of the dying stand, while showing little deviation from normal in lignin and pentosans, had considerably higher contents of resinous substances and other benzene/alcohol extractives, together with a markedly reduced cellulose content. As regards mineral constituents they showed a reduced K_2O content and increases in MgO and Fe_2O_3, but no marked difference in the remaining constituents, including CaO.

[1866]. 42.5 : 12.25 : 12.11.11. NĚMEC, A. Studie o minerální výživě odumírajících borových porostů v polesí Chrustenice. **[Studies on the mineral nutrition of dying Scots Pine stands in the Unterholz forest district.]** *Repr.* from *Sborn. české Akad. zeměd.* 15 (4), 1940 (423–9). [Cz.g.]

Dying of Scots Pine occurred especially on slopes above a roasting plant for iron ores. Analyses of needles and wood from dying and healthy trees, and comparison with data for healthy trees in other regions, showed significant differences in SO_3 content. In the Unterholz stands the SO_3 content of needles from healthy trees was 2–3 times, and of dying trees 3–4 times, as high as that of healthy trees from other regions, and the trouble must be attributed in the main to atmospheric pollution with SO_2.

[1867]. 42.5 : 12.26–8 : 12.11.11 : 12.14.5. VANSELOW, A. P. **The minor element content of normal, manganese-deficient, and manganese-treated English Walnut trees.** *Proc. Amer. Soc. hort. Sci.* 46, 1945 (15–20). L.S.

Spectrographic analyses have been made of samples of Walnut leaves from untreated and treated manganese-deficient trees, and from normal trees in two areas. The results for 15 of the minor elements show that manganese deficiency (*a*) does not seem to cause any material disturbance in the amount of other minor elements found in the leaf samples; (*b*) can be corrected if manganese sulphate is applied by spraying the tree during early summer or by injection of the dry salt into holes in the trunk or limbs. In general, the minor-element content of the Walnut leaf does not differ greatly from that of the normal Citrus leaf; barium is somewhat lower, and molybdenum and nickel are somewhat higher in the Walnut leaf.

43. FOREST FIRES

[1868]. 43 (481) : 09.4. NORWAY. Skogbrann i 1945. **[Forest fires in 1945.]** *Tidsskr. Skogbr.* 54 (9), 1946 (320). [Nor.] *Repr.* [from Statistisk Sentralbyrå.]

Statistics of various types of forest fires in Norway from 1936–45 inclusive.

43.0. *Predisposing Factors and Causes*

[1869]. 43.0 (71). **Origins of historic fires.** *Pulp Paper Mag. Can.* 48 (9), 1947 (127–8).

A study of conditions preceding some of the disastrous fires which have occurred during the past half-century has been made by the Ontario Department of Lands and Forests. Almost all these fires were preceded by the following

conditions:—(1) Precipitation lacking or below normal for 10 days previous to fire. (2) Temperatures averaging 80° F. for a week to 10 days previous to fire. (3) Humidity below normal for some days and below 45 on the day of the occurrence. (4) Wind velocity varying from 4 m.p.h. to tornado, usually from south-west.

[1870]. 43.0 (714). **Fire weather studies.** *Rep. B.C. For. Serv. 1946*, 1947 (35).

In an experiment conducted to ascertain the trend of fuel moisture in the shade, two sets of fuel-moisture sticks were placed at both valley and ridge stations, one set in the open and the other in the shade in each case. In every case, fuel-moisture content of the shaded sticks followed a similar general trend to that of the sticks in the adjoining open locations, but remained about 3 per cent. higher throughout the season. A study was also made of variation of fuel moisture between sticks placed on the ground and those placed 12 in. above the ground. Moisture content of the former was consistently higher. The difference was greater in the morning than in the afternoon and lessened as the season advanced. It is concluded that the present method of exposing fuel-moisture sticks 12 in. above the ground is entirely satisfactory and gives a suitable measurement of inflammability.

[1871]. 43.0 (775). MORRIS, W. M. **The forest fire hazard in the sunspot cycle.** *Fire Control Notes* 8 (4), 1947 (4–9).

A study made by the author in Wisconsin indicated that nearly all the great fires in the State occurred during periods of declining sunspot activity. It is suggested that similar studies should be made in other regions of the United States.

43.1. *Protective Measures*

[1872]. 43.11 (676). **[Fire-breaks.]** *Rep. For. Dep. Uganda 1946*, 1947 (12).

Native-authority forests in Lango are thickening as a result of fire protection, particularly where *Vernonia* spp. and suckers of *Albizzia zygia* are present. Attempts to hasten densification by planting groups of trees failed, and efforts are now being concentrated on complete fire exclusion by means of the most effective fire-break possible. *Phyllanthus discoideus* behind a double row of *Euphorbia tirucalli* is used for this purpose.

[1873]. 43.11 (759) : 12.25. SQUIRES, J. W. **Prescribed burning in Florida.** *J. For.* 45 (11), 1947 (815–19).

The author summarizes the purposes and methods of prescribed burning as practised on 300,000 acres of the Florida national forests during recent years. [Cf. *For. Abstr.* 8 (No. 2703).]

[1874]. 43.11 : 12.25 : 23.1. CHAPMAN, H. H. **Prescribed burning versus public forest fire services.** *J. For.* 45 (11), 1947 (804–8).

The author recounts the steps which have led to the conversion of most, though not all, American foresters to the belief that controlled burning is an essential part of the management of Longleaf Pine [*Pinus palustris*], and attacks the arguments of those still unconverted. [Cf. *For. Abstr.* 8 (No. 2703)]. He is now in favour of careful, prescribed burning at intervals of about 3 years, both in order to obtain established regeneration and in order to reduce fire hazard.

[1875]. 43.11 : 12.25 : 23.1 : 45.11. BRUCE, D. **Thirty-two years of annual burning in Longleaf Pine.** *J. For.* 45 (11), 1947 (809–14).

In 1915 the Robert Plots were established near Urania, Louisiana, to test the effect of annual burning and grazing on Longleaf Pine [*Pinus palustris*] seedlings. [For earlier reports cf. *For. Abstr.* 5 (26).] The following facts are now held to be demonstrated. (1) Swine destroy Longleaf seedlings and can prevent regeneration. (2) After the age of one year, Longleaf Pine seedlings (at least those on the better sites) can survive annual winter fires, and grow past the size at which they are retarded by these fires. (3) If fire be excluded from Longleaf land within the range of Loblolly and Shortleaf Pine, these species can invade the better sites. Even with heavy stands of Longleaf seedlings, Loblolly and Shortleaf can dominate the stand. Annual fires killed all Loblolly and Shortleaf seedlings and permitted the development of a fully stocked Longleaf stand. *From author's summary.*

[1876]. 43.11 : 11.62.11 : 34.21 : 91.4. **This burning question.** *Fm. & For.* 7 (2), 1947 (136–9).

The controversy on grass-burning in West Africa started in an earlier issue [cf. *For. Abstr.* 8 (555)] is continued by several correspondents.

Some of the disadvantages of complete fire-exclusion are brought out, e.g. substitution of useless soft-wooded seral species for the valuable savanna trees, and thickening up of the bush with consequent increase of tsetse in fly areas.

[1877]. 43.13. MOHLIN, T. Brandkårernas utnyttande vid skogsbrandsläckning. [**The use of ordinary fire brigades in forest fire fighting.**] *Skogen* 34 (13/14), 1947 (196–7). [Sw.sw.]

Concludes that the calling in of fire brigades to forest fires may be justified: (1) Within a reasonable radius from their base, where they have the advantage of speedy arrival in sufficient force and with adequate equipment for the job. (2) Chiefly for comparatively short operations for restricting the spread of a fire. (3) Only in smaller detachments, or for special tasks, if the fire is of long duration. (4) Mainly against the front of a fire, and against the flanks and rear only if the fire is small. (5) Only to a restricted extent for mopping-up operations, etc.

[1878]. 43.13. HALL, A. G. **Bombing fire!** *Amer. Forests* 53 (10), 1947 (448–9).

The U.S. Air Force and Forest Service have been collaborating in experiments in the aerial control of fire by dropping water bombs. Eight water bombs (converted auxiliary fuel tanks of 165 and 310 gal. capacity) were dropped on the head of a fire from a Boeing B-29 Superfortress. As the bombs burst over the fire and scattered their extinguishing load, other planes dropped smoke-jumpers and equipment to complete the job of control. Results were so successful that the project will be continued on an operational basis with P-47 Thunderbolt fighters, which have made successful glide bombing runs with two 165-gal. tanks. The principal use of this method is likely to be the checking of small, hot fires before they can spread to disastrous dimensions.

[1879]. 43.13 (73). EDSON, C. E., and PARKER, W. W. **The use of wetting agents in forest fire suppression.** *Fire Engng.* 100 (8), 1947 (550–4, 592). D.S.I.R.

Discusses the use of chemical agents added to water to alter its liquid properties, causing it to flow more readily, to penetrate into combustible materials such as ground litter, and to cool a surface by boiling away from it rapidly, thus hastening the extinguishing process. The essentials of a wetting agent are that it should be readily soluble in naturally occurring water, whether alkaline or acid, over a wide temperature range, should form a stable water solution, and be non-corrosive. Three forest fires are described where a commercial wetting agent was used with effect. [Cf. *For. Abstr.* 9 (p. 135)].

[1880]. 43.13 : 07.7. MACLEOD, J. C. **Effect of altitude, length of hose line and head on performance of forest-fire pumping units.** *For.-Fire Res. Note For. Serv. Can.* No. 13, 1947. pp. 56.

Includes 50 pages of tables giving the following data for six different pumping units (which are fully described): discharge in gallons per minute, pressure developed at pump and at the nozzle (lb./sq. in.), length of stream (ft.); all for heads ranging from 0 to 400 ft., nozzles of $\frac{1}{2}$, $\frac{3}{8}$ and $\frac{1}{4}$ in., hose lengths ranging from 0 to 6,000 ft., and elevations from sea level to 600 ft. [Cf. *For. Abstr.* 2 (242–3).]

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

44.1. *Forest Weeds*

[1881]. 44.1 (77). DAY, M. W. **The control of certain shrubs in the Lake States.** *Abstr. of thesis* in *J. For.* 45 (11), 1947 (792). [Dunbar Forest Exp. Sta., Sault Ste. Marie, Mich.]

Report on a study undertaken to determine the comparative effectiveness of several methods of controlling various shrubs. Sprays containing 2,4–D were most effective on Hazel and least effective on Mountain Maple [*Acer spicatum*]. In general, this substance was the most promising of those tried, for all species except Mountain Maple. Mechanical control included cutting and disking. July or August was the most effective period for cutting to prevent sprout growth. Disking was more effective than cutting, on areas suitable for such treatment.

[1882]. 44.1 : 12.26–8. PAGE, P. R. **Clearing Rhododendrons in woods.** *Quart. J. For.* 41 (2), 1947 (80–1).

An area of some 50 acres in Lincolnshire was overgrown with a continuous dense growth of Rhododendron (*R. ponticum*), with interlocking branches 6 in. thick, and 12–15 ft. high. Various ways of clearing the Rhododendrons

have been tried; the best method was found to be to cut off the branches in order to expose the stump of the main stem, and then pull this out by tractor winch, or by digging with mattocks. The cost of this work in the summer of 1946 was £15–20 per acre, including burning up. By the autumn, however, fresh shoots about 1 ft. high had appeared; these must be dug out while they are still small, and if the work is done carefully there should be few in the following year. This work was expected to cost about £5–7 per acre. There is a 6-in. layer of excellent leaf mould, free from weed seeds, and first-class natural regeneration of Birch from the sparse overstorey is expected. [Cf. *For. Abstr.* 9 (No. 1538).]

44.3. *Fungi*

See also *For. Abstr.* 9 (Nos. 1455, 1461, 1555).

[1883]. 44.3 (481). ROBAK, H. Tre skogsykdommer som hittil har vært lite kjent eller påaktet i Norge. [**Three tree diseases which have so far been little known or heeded in Norway.**] *Tidsskr. Skogbr.* 54 (10/11), 1946 (323–34). [Nor.]

Deals with the occurrence in Norway of *Phomopsis pseudotsugae* on Larch (*Larix decidua* and *L. leptolepis*); of *Meria laricis* on these 2 and *L. sibirica*; and of *Discella strobilina* on Spruce (*Picea abies*). The first is rare and mild; in all but 2 cases the affected trees can be traced to one nursery, but in most cases also they are growing in the neighbourhood of Douglas Fir plantations. The second is also mild except in one case where it is jeopardizing a whole plantation; all the plantations affected draw plants from one nursery. Many trees were found in 1942 to be seriously affected with the third. The late spring and summer of that year made it unlikely that frost was responsible for the onset of the disease. Many of the affected Spruce were also attacked by a *Chermes*—probably *C. strobilobius*.

[1884]. 44.3 : 12.19.23 : 12.19.2 : 12.25 (473). CHASTUKHIN, V. YA. Ekologiya epifitotii zapovednÿkh elovÿkh lesov. [**Ecology of fungus diseases in Spruce forest where felling is prohibited.**] *Sovetsk. Bot.* 15 (1), 1947 (17–26). [Russ.] [Mordovski Gosudarstvennÿ Zapovednik.] D.S.I.R.

In natural associations of Spruce protection forest, in Kalinin Province, the incidence of fungus attack on species of the ground flora was on the whole very slight, and such attacks occurred most often on the commonest species. Serious fungus attack was found chiefly on species characteristic of Oak forest.

[1885]. 44.3 : 12.21. WARDLAW, C. W. **Control of Banana wilt disease.** *Nature, Lond.* 160 (4064), 1947 (405).

An experiment in the control of Panama (wilt) disease of Banana (*Fusarium oxysporum cubense*) has been made in Honduras. An area of about 100 acres, which had gone out of cultivation because of the disease, was enclosed within earth banks and divided into sections, each of which was kept submerged for a different period of time. The experiment was based on the observation that soil fungi require oxygen to live, and that, when highly infected soil was submerged for one month under 2 ft. of water, no living *Fusarium* could be found in it. Areas originally flooded for 6, 12, and 18 months have now been producing fruit for 6 years and it is expected that several years of good production still lie ahead. It is improbable that this method of flood-fallowing will be successful in acid soils, but it is being extended to other areas considered suitable.

[1886]. 44.3 : 12.25 : 12.21 (485). SJÖSTRÖM, H. Om tallens föryngring och snöskyttet. [**Regeneration of *Pinus sylvestris* and the 'snow blight' caused by *Phacidium infestans*.**] *Norrlands SkogsvFörb. Tidskr.* 1946 (3), (421–50). [Sw.sw.]

Attacks by *P. infestans* greatly hinder regeneration of Scots Pine in the interior of Norrland, and their severity increases with increasing altitude and latitude. The strong tendency of natural regeneration to occur only in groups, often beside logs or felling debris, appears to be due to some factor or factors limiting the attacks of the fungus in such places. Sjöström has made several experiments in which cull logs were propped against one another so as to form a permanent break in the snow cover over promising groups of regeneration and has found that this practice considerably reduces *Phacidium* attack in comparison with control areas. He suggests that the chief factors involved may be (1) Mechanical support against snow pressure, foliage not

deeply buried in snow being at a lower temperature and thus less liable to the development of *Phacidium*. (2) A general lowering of the temperature in the groups, caused by the break in the snow cover and consequent penetration of cold air. (3) A rather earlier snow melt in the protected groups, which are thus freed of snow at a particularly dangerous period. Regeneration that develops very slowly in groups under canopy probably benefits from similar influences due to the existence of cover.

The best insurance against the fungus is considered to be the use of rapid-growing stock of local provenance, or preferably somewhat hardier strains with early autumn lignification of shoots. The gappiness of existing regeneration is due, *inter alia*, to repeated *Phacidium* attack and to root competition from vigorously growing trees. Possible control measures in such cases are the piling of cull timber about promising trees or groups as described above, and the reduction of snow drifting and root competition in gaps, e.g. by destroying weeds with chlorate, removal of the more pronounced wolf trees, and severely pruning vigorous trees of good crown type and quality (simultaneously reducing root competition and improving the timber).

[1887]. 44.3 : 12.26–8 : 12.21. MARTIN, W. J. ***Alternaria* leaf blight of *Hevea* rubber trees.** *Phytopathology* 37 (9), 1947 (609–12).

[1888]. 44.3 : 12.26–8 : 12.21 : 45.3 : 13.2. BARTER, G. W. **The Beech scale.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 3 (4), 1947 (1).

Studies of scale infestation (*Cryptococcus fagi*) of *Fagus grandifolia* on permanent sample plots, which have been made for some years in New Brunswick, lead to the following conclusions:—External symptoms of *Nectria coccinea* infection usually occur after two years of heavy scale attack. The danger of infection increases with the severity of scale infestation, which in turn increases with size of tree and percentage of Beech in the stand. The degree and spread of *Nectria* infection increase as the number of heavily infected trees accumulates. Loss can be prevented and the infestation checked by prompt cutting of the heavily infested trees and the larger uninfested trees of merchantable size. Heavily infested trees must be utilized as soon as the foliage shows signs of yellowing, if sound logs are to be obtained.

[1889]. 44.3 : 12.26–8 : 12.21. HENRY, B. W., and RIKER, A. J. **Wound infection of Oak trees with *Chalara quercina* and its distribution within the host.** *Phytopathology* 37 (10), 1947 (735–43).

Typical Oak wilt developed in, and *Chalara quercina* was re-isolated from, Black Oak [*Quercus velutina*] woodland seedlings and sprouts and from greenhouse seedlings of Red Oak [*Q. borealis*], all wound-inoculated in vascular tissues of the roots, stems, branches, twigs, and leaves. Various isolates of the pathogen did not appear to be host-specific among Bur [*Q. macrocarpa*], Red, and Black Oaks. *Chalara quercina* was distributed throughout the crowns of wilting trees, including apparently unaffected branches and leaves. Roots were found to be diseased in more than half the trees tested. The fungus was isolated from current, 1-year-old, and 2-year-old wood of the stems of wilting trees. *From authors' summary.*

[1890]. 44.3 : 12.26–8 : 12.21 (756). LAIR, E. D. **Smooth patch, a bark disease of Oak.** *J. Elisha Mitchell Sci. Soc.* 62 (2), 1946 (212–20). [Duke University, Durham, N. Carolina.] L.S.

Four species of fungus occurring on smooth patch lesions of *Quercus alba* and *Q. stellata* in the neighbourhood of Durham, N. Carolina, were investigated. All of these, *Aleurodiscus oaksii*, *Trichoderma viride*, *Xylaria* sp. and a new species of *Corticium*, named by the author *C. maculare*, were able to produce loss of substance in bark blocks, but the mycelia of all except *C. maculare* were restricted to the surface of the blocks and did not cause the type of decay characteristic of smooth patch in this district.

[1891]. 44.3 : 12.26–8 : 12.21 (548). THIRUMALACHAR, M. J. **Some new *Sphaceloma* diseases of economic plants in Mysore.** *Trans. Brit. mycol. Soc.* 31 (1/2), 1947 (1–6). O.B.D.

Sphaceloma diseases of *Santalum album*, *Osyris wightiana* and *Nerium oleander* are described.

[1892]. 44.3 : 12.26–8 : 12.21 : 13.2 (71). POMERLEAU, R. **Means of inoculation of the**

Dutch Elm disease by *Hylurgopinus rufipes* Eichh. *Canad. J. Res.* 25C (3), 1947 (102–4 + 1 plate). P.R.

Thirty young Elms recently and naturally infected by *Ceratostomella ulmi* were cut down and examined. In most cases it was possible by following the characteristic brown streaks to discern one or more places where the infection originated. Such places are always connected with a small tunnel dug by an insect through the thin bark. The frequent presence of adults of *H. rufipes* in the tunnels leaves no doubt that they are the disease-carriers.

[1893]. 44.3 : 12.26–8 : 12.21. ZENTMYER, G. A., HORSFALL, J. G., and WALLACE, P. P. **Dutch Elm disease and its chemotherapy.** *Bull. Conn. agric. Exp. Sta.* No. 498, 1946. pp. 70.

A review of results to date of research on control of the disease carried out at the Connecticut Agricultural Experiment Station since 1940 with particular reference to control by immunization or chemotherapy, but including studies in the biology of the fungus, factors of inoculation and progress of the disease in the tree, factors in the long- and short-range spread of the disease, and therapy by pruning.

[1894]. 44.3 : 12.26–8 : 12.21. BAGCHEE, K. D. **An unrecorded parasite of Teak (*Tectona grandis* Linn. f.) reported from Dehra Dun.** *Indian For.* 73 (7), 1947 (332–4 + plates).

A disease of young Teak trees, characterized by the leaves turning yellow and falling very prematurely and by lesions under the bark, followed by the appearance of pink to red perithecia in the cracks and cavities of the bark. The pathogen appears to resemble *Hypomyces haematococcus* (Berk. et Br.) in the septation of the conidial spores, and *Nectria haematococcus* as regards the perithecia and the ascospores, which are feebly striated.

45. DAMAGE BY ANIMALS

45.1. *Mammals*

See also *For. Abstr.* 9 (No. 1875).

[1895]. 45.1 : 07.7. MILLEN, T. W. **Electric fences.** *Trop. Agriculturist, Ceylon* 102 (2), 1946 (112–14). L.S.

Notes on experiments in the use of electric fences to confine cattle at the Allahabad Agricultural Institute. Current consumption is about 1 KW. unit per month for confining 200 animals, provided the line is kept free from short circuits. Wooden posts were used at first, but proved vulnerable to white-ant attacks; iron posts are too easily shorted and are also difficult to obtain in quantity. Use is now being made of concrete posts made from broken bricks held together with cement and reinforced with pieces of old fence wire. A short threaded iron rod is embedded in the top, and the porcelain insulator bolted to it. These posts are 4 in. sq. at the base, tapering to 3 in. sq. at the top and are 4 ft. long; their cost was Rs. 1–6–0 each and the insulators 5 as. each; they are spaced 15 ft. apart. The height of the wire is determined by the type of animals to be confined, and is adjusted by burying the posts to the desired depth.

[1896]. 45.12 : 13.2 (498). PAŞCOVSCHI, S. Atacul şoarecilor asupra unor arbori exotici. [**Mouse damage to some exotic trees.**] *Rev. Pădurilor* 54 (11/12), 1947 (466–8). [Rum.g.]

Account of damage by *Apodemus sylvaticus* to young trees of *Ginkgo biloba*, *Liriodendron tulipifera*, *Fraxinus americana*, and *Cladrastis lutea*. The bark of the first two species was sometimes completely ringed in trees up to 30 cm. in diameter during the winter; in other cases it was the roots which were eaten.

45.2. *Birds*

[1897]. 45.2 : 13.2 : 23.23 (795). ADAMS, L. **Food habits of three common Oregon birds in relation to reforestation.** *J. Wildlife Mgmt.* 11 (3), 1947 (281–2). B.A.P.

Tabulates results of analysis of the stomach content of *Junco oregans*, *Zonotrichia leucophrys*, and *Pipilo maculata* to determine whether they were eating Douglas Fir seeds. The birds were caught in traps set in areas scattered with equal amounts of oats and Douglas Fir seed, during the period February 15–June 15, 1946. The table shows an obvious preference for oats; 32 of the 50 stomachs examined contained oats while 6 contained seed. Feeding-tray experiments using different kinds of food confirmed these results. Of the different kinds of birds visiting the tray, the varied thrushes preferred

Douglas Fir seed to all other foods, Juncos almost without exception preferred oats and no other kinds of birds touched the Fir seed. As varied thrushes are not likely to occur in areas being reseeded to Douglas Fir, their significance as a factor in seed losses would be small.

45.3. *Insects*

See also *For. Abstr.* 9
(Nos. 1495, 1853, 1855, 1888, 1892).

[1898]. 45.3 (492). ELTON, E. T. G. Overzicht der beschikbare gegevens over insectenplagen in onze bosschen en andere houtopstanden in het jaar 1946. **[Review of available data on insect pests in Dutch forests and other woody growth in 1946.]** *Ned. Boschb.-Tijdschr.* 19 (9), 1947 (247–54). [Du.e.] [Biologisch Laboratorium 'Hoenderloo'.]

The data are summarized in two tables: (1) a list of insect pests arranged by host species; (2) degree of damage inflicted in the different provinces by each insect species. [Cf. *For. Abstr.* 8 (No. 2118).]

[1899]. 45.3 (498) : 92. DEMETRESCU, I. C. Intervenționismul de stat in materie de combaterea insectelor vătămătoare pădurilor. **[State intervention in the control of injurious forest insects.]** *Rev. Pădurilor* 54 (5/6), 1947 (206–15). [Rum.f.]

The Rumanian law of April 22, 1942, requires forest owners to inform the local authorities, who must then inform the forest authorities, of the appearance of any insect pest. The latter decide what control measures the landowner must take, and the local authority is obliged to contribute to the expense of carrying them out. The law also created a forest fund 'for special purposes', which is largely supplied by a levy of 0·5 per cent. on the revenue of all Rumanian forests. The author criticizes the actual working of this law.

[1900]. 45.3 : 13.2. PASCU, V. Cucul și importanța lui în protecția pădurilor. **[The cuckoo and its importance in forest protection.]** *Rev. Pădurilor* 56 (3/6), 1944 (112–6). [Rum.f.]

The Cuckoo eats hairy caterpillars, e.g. those of *Cnethocampa processionea*, *Lymantria monacha* and *L. dispar*, which are not eaten by other birds. [Cf. *For. Abstr.* 8 (No. 2318).]

[1901]. 45.3 : 13.2 : 13.15. MACKENZIE, J. M. D. **Bats.** *Forestry* 21 (1), 1947 (99–107).

A general outline of some of the main facts about bats is given. They are voracious, eating as much as ½ to ⅔ of their own weight of insects in a night. Their nocturnal food includes large numbers of protectively coloured insects which rest by day and so tend to escape diurnal birds. Some bats live in woods and may be important as insect controls. A list of British bats is given, and data by Poulton and others on the insects commonly eaten by bats. The provision of roosting boxes in woods is suggested, to encourage bats and to take the place of the hollows in trees removed in silvicultural fellings. *Author's summary.*

[1902]. 45.3 : 12.25 : 13.2 (438). KAPUŚCIŃSKI, S. Znamionek jałowcovy *Megastigmus kuntzei* n.sp. (Hymenoptera, Chalcididae) szkodnik nasion jałowca pospolitego (*Juniperus communis* L.) **[*Megastigmus kuntzei* n. sp., a pest of the seeds of Common Juniper.]** *Rozpr. Spraw. Inst. Bad. Leśn., Kraków* (*Ser. A*) No. 47, 1946. pp. 129 + 12 plates. [Pol.e.]

Description, life history and distribution.

[1903]. 45.3 : 12.25 : 13.2 : 2. MCLINTOCK, T. F. **Silvicultural practices for control of Spruce budworm.** *J. For.* 45 (9), 1947 (655–8).

[1904]. 45.3 : 12.25 : 13.2. BARKER, R. B., and FYFE, H. A. **A mixed infestation in the Spruce Woods Forest Reserve, Manitoba.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 3 (4), 1947 (3).

A mixed infestation has developed with the Spruce budworm (*Archips fumiferana*) and the Spruce foliage worm (*Dioryctria veniculella*) present in about equal numbers in some areas. Considerable mortality was seen to be inflicted on the budworm larvae by the foliage worm larvae, and controlled studies indicated that this predation took place only when insufficient Spruce foliage was available to the latter.

[1905]. 45.3 : 12.25 : 13.2 : 12.11.3. **Hybrid Pine may prove answer to Pine weevil menace.** *Timberman* 48 (11), 1947 (52, 54, 56).

The Institute of Forest Genetics, Placerville, Calif., has been making tests of a number of true and hybrid Pines in an attempt to find a tree resistant to the attacks of *Cylindrocopturus*

eatoni, which is an extremely destructive pest of Pine regeneration in California. Tests were made on *P. ponderosa*, *P. ponderosa* var. *scopulorum*, *P. jeffreyi*, *P. washoensis*, *P. contorta* and the hybrids *jeffreyi* × *coulteri*, *ponderosa* × *ponderosa* var. *scopulorum*, *washoensis* × *ponderosa* and *contorta* × *banksiana*. All showed various degrees of susceptibility except the hybrid *P. jeffreyi* × *P. coulteri*. In one nursery bed 8 of these hybrids and 8 Jeffrey Pine seedlings, all from the same Jeffrey Pine seed tree, were heavily attacked by the weevils, but whereas 5 of the Jeffrey Pine seedlings died in the autumn, all the attacked hybrids survived through the winter and made normal growth next year. Micro-sections taken during the autumn and winter from similarly attacked trees showed that the weevil deposited its eggs in the phloem of these trees and that the first-stage larvae mined the outer phloem but failed to reach the inner cambium cells and made no appreciable growth. Apparently this was because the tree promptly built a layer of new tissue round the initial mine made by the larva. The larvae remained alive during the autumn and winter, but did not grow, and died off in the spring when new tree growth started. The capacity of the tree to wall off the initial injury and thus prevent the larvae from reaching the cambium is undoubtedly connected with the physical and chemical characters of the phloem, and there is good reason to assume that these traits are hereditary and can be transmitted to progeny.

[1906]. 45.3 : 12.25 : 13.2 (794). WEST, A. S. **The Californian flat headed borer (*Melanophila californica* Van Dyke) in Ponderosa Pine stands of northeastern California.** *Canad. J. Res.* 25D (3), 1947 (97–118 + 4 plates). P.R.

Discusses studies on the biology of the Californian flatheaded borer and tabulates information on the mortality of incipient larvae, the injury caused by adults feeding on needles of caged Ponderosa Pine poles, and adult emergence from the bark of naturally infested trees and from slash.

The studies show that larval broods may spend several years in an incipient stage in the living host tree. During this period the galleries are healed over behind the larvae and the abnormal tissues thus developed interfere with normal conduction in the wood. Undetermined factors associated with the death of the host tree initiate a fast-growing larval stage in which feeding is voracious. As an average of 30 per cent. of any season's brood die every year, few larvae reach this stage.

No attempt is made to assess the role of the species in the 'Western Pine-beetle problem' but it is suggested that its part in the insect-caused losses in Ponderosa and Jeffrey Pine stands in north-eastern California may hitherto have been underestimated.

[1907]. 45.3 : 12.25 : 13.2. PASTRANA, J. A. La mariposita europea del brote del pino *Rhyacionia buoliana* (Schiffermuller). [**The European Pine shoot moth *Rhyacionia buoliana***.] [*Publ.*] *Inst. Sanid. veg. Argent.* (*Ser. A*) No. 15, 1946. pp. 11 + plates. [Span.e.]

The European Pine shoot moth was first recorded in the Argentine in 1939, attacking *Pinus insignis* near Buenos Aires. A hymenopterous larval parasite *Idechthis pastranai* Bluch. has been bred there but biological control measures have not yet been undertaken. Descriptions of the pest and of control methods are included.

[1908]. 45.3 : 12.25 : 13.2 (796). BODINE, L. V. **Operation flit gun.** *Amer. Forests* 53 (10), 1947 (440–3).

Account of the successful aerial spraying of 400,000 acres of Douglas Fir in Idaho, which were severely infested with tussock moth [*Hemerocampa pseudotsugata*]. An atomized spray of 1 lb. DDT and 1 gal. fuel oil was used. No live caterpillars could be discovered after the operation and no noticeable damage to fish or wild life.

[1909]. 45.3 : 12.26–8 : 13.2 (4) : 13.15. ARDÖ, P., and LINDQUIST, B. Om *Laspeyresia grossana* Haw. som skadedjur i de nordvästeuropeiska bokskogarna. [***Laspeyresia grossana* as a pest in the Beech forests of north-western Europe.**] *Medd. Skogsforskn-Inst., Stockh.* 36 (4), 1947. pp. 30. [Sw.e.]

Reviews earlier literature, which is scanty; describes the morphology and, so far as known, the biology of the larva, which lives in Beech nuts; and surveys the distribution and importance of the species in N.W. Europe.

L. grossana is shown to be common not only in S. Sweden but also in S. Norway, Denmark and Great Britain. It is not restricted to

Beech in its natural range, but occurs in most of the planted, more northerly Beech woods. Infestation in such peripheral areas appears to be less severe than in the more southerly regions. In spite of a lack of records for 1937–39, there is evidence of periodicity in the attacks: 1930, 1933, 1934 and 1935 were all years of low frequency of attack, whereas marked increases were noted for 1940, 1941 and 1946.

As in some places 50–80 per cent. of the Beech mast has proved to be damaged by the larvae, it is clear that under favourable environmental conditions this insect might become a serious menace to Beech regeneration.

[1910]. 45.3 : 12.26–8 : 13.2 : 41. DOWDEN, P. B. **Experiments with DDT for the control of the gypsy moth, particularly with aerial equipment.** U.S. Bureau of Entomology and Plant Quarantine. 1947. pp. 13.

A detailed report on successful experiments for the control of *Lymantria dispar* by spraying with DDT, especially from the air [cf. *For. Abstr.* 8 (No. 2770)]. Only about 200 acres of woodland can be treated during a season with a power sprayer on the ground, compared with about 10,000 acres from a small plane. [Cf. *For. Abstr.* 9 (No. 1853).]

[1911]. 45.3 : 12.26–8 : 13.2 (469). BAETA NEVES, C. M. Los principales insectos que atacan al alcornoque en Portugal. [**The principal insects attacking Cork Oak in Portugal.**] *Montes, Madrid* 3 (14), 1947 (140–7). [Span.]

Cork Oak in Portugal covers almost 650,000 ha. of land and produces a yearly average of 130,256,571 kg. of cork. Damage by *Lymantria dispar* has been great enough to warrant the setting up in 1946 of a Commission which is investigating control measures. Other pests encountered are *Tortrix viridana, Euproctis phaeorrhoea, Coroebus undatus, C. fasciatus, Cremastogaster scutellaris* and *Cerambyx cerdo*. A brief account of these and some minor pests is given.

[1912]. 45.3 : 12.26–8 : 13.2. LUPE, I. Un atac de *Otiorrhynchus* la puețe de stejar. [**An infestation of *Otiorrhynchus* on [nursery stock of] *Quercus robur*.**] *Rev. Pădurilor* 61 (1/4), 1946 (17–20). [Rum.f.]

[1913]. 45.3 : 12.26–8 : 13.2. (437). KOMÁREK, J. Škody puklicí lískovou—*Lecanium coryli* L. na jasanech lužních lesů. [**Damage by *Lecanium coryli* to Ash in floodland forests.**] *Repr.* from *Vestn. čsl. zool. Společ.* 1946 (10), (156–65 + 2 plates). [Cz.e.]

Ash [*Fraxinus excelsior*] is the chief host of *L. coryli* in the floodland forests of Czechoslovakia. Mass increase of the insect occurs in cycles of between 10 and 20 years, and at peak periods other trees and shrubs are also severely attacked. The present paper deals mainly with the damage caused in tissues of Ash twigs by the sucking mouth-parts of the coccid. Serious damage is caused only by the adolescent female, which may increase 10–15 times in volume in the course of one month. The mouth-parts of such females pierce vertically through the cambium to the xylem; later, the cells round the puncture die, and the mouth-parts of dead females (left behind when the latter fall off) are surrounded by brown cells in patches 1–2 mm. in diameter. Since this diameter is less than that of an adult female, complete girdling of a twig in one circumference cannot occur even when the coccids touch one another, but girdling does in effect occur through the superposing of dead areas along the length of a shoot. In view of the destruction of cell walls in the punctured tissue, it is believed that a cellulase must be present in the salivary secretion.

Young trees, especially in plantations, suffer markedly from attack by *L. coryli*, and in the period 1925–30 a great number of trees in Bohemia were killed. Large old trees with good crowns do not appear to die, even when the scale population is very great, unless the attack is accompanied by severe cold or a change in ground-water level. In 1939–42, a period of abnormal winter cold, old trees in S. Moravia died only when *L. coryli* was present in very great numbers. In 1942–45 practically all adult Ash trees in the same region died, but it is doubtful whether the main cause was severe winter frost, change in water-table or coccid attack.

[1914]. 45.3 : 12.26–8 : 13.2 : 41. FRANSEN, J. J. De gevoeligheid van de rupsen van den satijnvlinder (*Leucoma salicis* L.) voor derris en pyrethrum. [**The susceptibility of satin-moth larvae to derris and pyrethrum.**]

Ned. Boschb.-Tijdschr. 19 (4), 1947 (103–6). [Du.]

Laboratory tests on larvae varying between 28 and 36 mm. in length, using derris or pyrethrum in talc dust, indicated that the larvae were relatively insensitive to rotenone but susceptible to pyrethrin, the lethal doses of these substances being respectively 0·031 mg. and 0·002 mg. per larva in the case of the largest larvae and about half of these quantities for the smallest in the tests. Newly hatched larvae are probably many times more susceptible. In spite of the high cost of pyrethrum preparations, it should pay to use them, in view of their effectiveness and of the great loss of increment (50 per cent.) which Poplars may suffer as a result of defoliation [cf. *For. Abstr.* 9 (No. 608)]. New insecticides such as DDT should also be tested for use against satin moth larvae.

[1915]. 45.3 : 12.26–8 : 13.2 : 13.15. Barbey, A., and Bovey, P. Observations sur la biologie et les dégâts d'une tordeuse du Peuplier. **[Notes on the biology and damage of a Poplar tortricid [*Gypsonoma neglectana*].]** *Repr.* from *Bull. Soc. vaud. Sci. nat.* 62 (259), 1943 (221–8). [F.]

[1916]. 45.3 : 12.26–8 : 13.2 : 13.15. Bovey, P., and Ferrière, C. Sur quelques parasites des tordeuses du genre *Gypsonoma* Meyrick. **[Some parasites of tortricids of the genus *Gypsonoma*.]** *Repr.* from *Mitt. schweiz. ent. Ges.* 19 (6), 1944 (199–201). [F.]

45.4. *Other Animals*

[1917]. 45.4 : 12.25 : 13.2 : 07.7. Neiswander, R. B., and Rodriguez, J. G. **Control of Spruce mite.** *J. econ. Ent.* 40 (3), 1947 (419–21).

Experimental spraying of trees (*Picea*, *Thuja* and *Juniperus* spp.) infested with *Paratetranychus ununguis* gave good results; Dowspring-17 at the rate of 12 oz. in 100 gal. of water gave an average mortality of 99·4 per cent. Good results were also obtained with DN Dust 269.

47. INJURIES OF ALL KINDS TO INDIVIDUAL TREE SPECIES

See also *For. Abstr.* 9 (No. 1498).

[1918]. 47 (91). Beekman, H. A. J. M. Boschbeschadigingen en boschbescherming in Indonesië. **[Forest injuries and protection in Indonesia.]** *Publ. Stichting 'Fonds Landbouw Exportbureau 1916–1918', Wageningen* No. 30, 1947. pp. 164. [Du.]

Summarizes the present state of knowledge, from literature (217 refs.) and from the author's own experience, under the main headings:—(1) *Primary natural agencies*—water, drought, temperature, insolation, lightning, fire, wind and volcanic influences. (2) *Living beings*—man, domestic animals, wild mammals, birds, insects (almost one-third of the work concerns the last-named, grouped according to part of host attacked), and plants (including weeds, climbers, epiphytes, parasitic phanerogams and fungi). There is an index of subjects, species (both plant and animal), and vernacular, geographical and authors' names. The work is not illustrated.

[1919]. 47 : 12.25 (44) : 43 : 44.3 : 45.3 : 66. Sargos, R. Causes d'altération du bois de pin et nécessité d'un cahier des charges des coupes. **[Causes of deterioration of Pine timber and need for regulation of fellings.]** *Rev. Bois Appl.* 2 (2), 1947 (7–11). [F.] P.R.

Discusses the effects on the Landes forests of the serious forest fires of 1942–46, the increase in fungus and insect attacks and means of combating the latter with insecticides and the introduction of insects parasitic on *Ips sexdentatus*, which causes most of the damage. Amongst other desiderata, the need for official regulation of the period and extent of fellings is emphasized.

[1920]. 47 : 12.26–8 (492). Truter, S. J. Een voorlopig onderzoek naar de insterving van *Alnus glutinosa* (L.) Gaertner. **[A preliminary investigation of the die-back of *A. glutinosa*.]** Uitgeverij en Drukkerij Hollandia, Baarn. 1947. pp. 110 + 9 plates. [Du.du.]

Contains chapters on: (1) Distribution (including evidence from pollen analyses) and economic value of the species. (2) Literature on its die-back. (3) Occurrence and symptoms of the disease in Holland. (4) Laboratory investigations and fungi isolated. (5) Inoculations. (6) Soil investigations.

Holland has no high-forest plantations of Alder, and die-back occurs chiefly in natural stands; the trees used for roadside plantations, etc., are mostly coppiced on a 5- to 8-year rotation, and symptoms of the disease seldom

appear before the 8th year. The disease has been noted in several localities in Holland, on different soils with very different water-tables.

In the present study many fungi were isolated from dead bark, wood and roots, and inoculations were made on healthy trees, using mainly fungi that had been isolated from more than one diseased tree. No die-back symptoms similar to those observed in nature could be obtained. *Cryptosporiopsis grisea* and *Phomopsis alnea* were capable of local and temporary attacks on the bark of defective or slow-growing trees; *Fusarium sporotrichioides* can temporarily stimulate the bark to callus formation, though comparable attacks have not been observed in nature. *Cryptosporium neesii* (= *Cryptospora suffusa*), to which the disease has been ascribed in Denmark, appears to be a saprophyte on dead bark of diseased trees. There was no evidence for the parasitic or non-parasitic nature of *Valsa oxystoma*, which is regarded in Belgium as the causal agent. The remaining fungi tried gave negative or doubtfully positive results, and preliminary analyses of soils under diseased and healthy trees brought to light no evidence of its cause.

Fungi alone cannot be held responsible for the disease, which is probably due to a complex of factors. It is suggested that as the latter may be largely physiological, thorough chemical analyses of diseased and healthy plants, and of the soils on which they occur, might elucidate the problem.

[1921]. 47 : 12.26–8 (498). GEORGESCU, C. C., TEODORU, I., and BADEA, M. Uscarea în massă a stejarului. [**Mass die-back of Oak.**] *Rev. Pădurilor* 57 (4/6), 1945 (65–79). [Rum.f.]

During the years 1940–44, extensive die-back of Oak was observed throughout Rumania, principally in *Quercus robur*, but also in *Q. pedunculiflora* and *Q. cerris*. On the sick or dying trees were found infestations of *Lymantria dispar*, *Tortrix viridana*, *Malacosoma neustria*, *Cheimatobia brumata*, *Xyleborus dryographus*, *Platypus cylindrus*, and various fungi, including *Armillaria mellea*, *Fistulina hepatica* and *Fusarium* spp. The establishment of these pests was facilitated by weakening of the trees due to a variety of causes much debated. The authors consider that the most important of these was the unfavourable influence of the almost impermeable B horizon of the compact soils. In particular, the alluvial soils and river terraces which are in course of podzolization retain for long periods the water from the melting snow. During the summer the same soils are subject to excessive drying. In such conditions, the Pedunculate Oak disappears, being replaced successively by *Q. cerris* and *Q. frainetto*. The stagnation of ground water was particularly serious in the springs of 1940 and 1942, following exceptionally snowy winters, and its effect was reinforced by repeated defoliations by the caterpillars mentioned above, and finally by severe infestations of *Ophiostoma valachicum* and *O. roboris* and also a bacterium (*Bacterium quercus*) which are carried by *Xyleborus* and *Platypus* spp.

[1922]. 47 : 12.26–8 (498). PAȘCOVSCHI, S. In chestiunea uscării stejarului. [**Die-back of Pedunculate Oak.**] *Rev. Pădurilor* 57 (10/11), 1945 (238–45). [Rum.g.]

The author investigated the wholesale die-back of Pedunculate Oak in the neighbourhood of Timizoara (Banat province). The following causes were discovered:—(1) Defoliation by caterpillars of *Lymantria dispar*, *Tortrix viridana* and *Cheimatobia brumata* in 1940–42. (2) Injury by mildew (*Microsphaera alphitoides*), which sometimes led to a second defoliation in the same summer as a caterpillar infestation. (3) The long, cold winters of 1939–40 and 1941–42. (4) The dry summers of 1942 and 1943 in which, in addition to deficient rainfall, the August-September temperatures were usually high and the relative humidity very low. (5) Injury from a species of *Ceratostomella*. Finally, the author examines the question of the influence of stagnant water to which, unlike most Rumanian foresters, he assigns only a slight and local importance.

[1923]. 47 : 12.26–8 : 12.21 (498). GEORGESCU, C. C. Uscarea în masă a stejarului. [**Mass death of Oak.**] *Rev. Pădurilor* 54 (11/12), 1947 (460–5). [Rum.f.]

Describes a general dying back of Pedunculate Oak in Wallachia on compact, alluvial soils. A fungus believed to be a species of *Ceratostomella* was observed in the sapwood of the dying trees.

[1924]. 47 : 12.26–8 : 12.12. GURNEY, R. **Witches' brooms on Willows.** *Repr.* from *Northw. Nat.* Sept.-Dec., 1946. pp. 4 + 2 plates.

The author has satisfied himself by close

study that witches' brooms on *Salix fragilis* are always abnormal developments of the female catkin. The first sign of abnormality is the increased size of the ovary and its splitting at the end. Thereafter all sorts of abnormalities appear, which often take the form of proliferation of the nectaries. He found no evidence for the theory that the witches' broom is largely due to hypertrophy of the bracts. In *S. vitellina*, witches' brooms were found to develop in the same way, but complicated by the fact that catkins may bear flowers of both sexes or of transitional form. In such cases the female flowers may be modified, but the male flowers never. *S. triandra* does not develop witches' brooms, but in the second, July flowering that is characteristic of this species, abnormal female catkins occur which appear to be of the same nature as the witches' brooms on *S. fragilis*. No causative agent has been observed; the writer inclines to the view that it may be a virus.

5. MENSURATION. INCREMENT. YIELD.

[1925]. 5 : 02.1 (481) : .6 : 7. BØHMER, J. G. Skogtaksasjon. **[Forest mensuration, management and finance.]** J. G. Tanum, Oslo. 1945. pp. 166. [Nor.] Price Kr. 10.50.

An elementary textbook for forest ranger schools.

52. MEASUREMENT OF TREES AND TIMBER

[1926]. 52 : 01.7. GURAN, I. Relaţia şi corelaţia. **[Relation and correlation.]** *Rev. Pădurilor* 55 (9/10), 1943 (389–91). [Rum.f.]

Applying Pearson's formula for correlation factor to figures of the distribution of trees in a stand by diameter and height classes, the author found the coefficient 0·978, which proves that a direct and close correlation exists between tree diameter and height.

[1927]. 52 : 07.7. KORSUŇ, F., Návrh zdokonaleného dendrometru. **[Design of an improved dendrometer.]** *Lesn. Práce* 26 (6), 1947 (185–90). [Cz.russ.e.]

After extensive study of 22 different dendrometers, and having working experience of many of them, Korsuň has designed an improved model (diagrammatically illustrated) to combine the advantages of Hossfeld's and Klaussner's instruments. The essential features are 3 metal scales forming a modified Klaussner hypsometer, and a telescope, mounted on one of the scales, provided with a transparent micrometer scale for taking diameter measurements at any desired stem height. It is claimed that this instrument will save 30 per cent. in working time as compared with Liljenström's dendrometer.

52.3. *Form Classes. Form Factors. Form Quotients*

See also *For. Abstr.* 9 (Nos. 1516–17, 1574).

[1928]. 52.3 : 12.26–8 : 52.2. PAVELESCU, I. M. Grosimea arborilor la diferite înălţimi. **[The diameters of trees at different heights.]** *Rev. Pădurilor* 56 (7/9), 1944 (188–91). [Rum.f.]

A table for calculating the d.b.h. of a tree from the diameter of its stump at ground level, 0·2, and 0·3 m., based on measurements of 1,000 Sessile Oaks in the Radeşti forest, Muscel province of Rumania.

52.4. *Measurement of Volume*

[1929]. 52.43. TOMA, G. T. Comparaţie între două metode pentru cubajul arboretelor. **[Comparison between two methods of measuring stand volume.]** *Rev. Pădurilor* 55 (9/10), 1943 (365–73). [Rum.g.]

The two methods compared are (1) that of the Prussian Forest Research Institute, and (2) that of local volume tables. (1) consists in making an inventory by 1-cm. diameter classes, arranging these data in groups for every 5 cm. of diameter in ascending order, and calculating volume of each group from the formula $V = G.H.F$, in which G = basal area, H = mean height, and F = the mean form factor for the class. The author calculated the volume of a plot of Robinia (0·25 ha.) by both methods; the whole stand was then felled and the volume of every stem measured sectionally. The error in the results of applying method (1) was – 5·3 per cent. for sawtimber and – 1·9 per cent. for total volume, and for method (2) – 5·3 per cent. and + 0·4 per cent. respectively.

[1930]. 52.43.2. TOMA, G. T. Cercetări asupra cubajului exact şi c bajului expeditiv la buşteni. [**Study of exact and of expeditious measurement of logs.**] *Rev. Pădurilor* 57 (10 11), 1945 (205–14). [Rum.f.]

The author examines the precision of volume measurements of logs made by Huber's method (volume = mid-section area × length) by comparing it with the results obtained by the sectional method (assuming the log to be divided into 2-metre lengths). He first carried out a preliminary investigation to determine whether, in using the sectional method, it is necessary to measure diameters in millimetres, as is usually done at forest research institutes, or whether measurements to the nearest centimetre suffice. It is shown that there is a probability of 66·5 per cent. that, in the latter case, the individual error will not exceed 1 per cent.; a probability of 71 per cent. that the error will be positive, 24 per cent. that it will be negative, and 5 per cent. that there will be no error. The largest absolute errors are found in logs of large dimensions, the largest relative errors in logs of small dimensions.

In the comparative study of Huber's method and the sectional method (diameters measured to nearest centimetre) the material used was 1,000 stems of Spruce (mean diameters 8–48 cm., lengths 10–46 m.) felled in the Călimani Mountains. The total volume of the 1,000 stems, measured sectionally, was 1,186.901 cu.m.; by Huber's system 3·65 per cent. less. Of the individual stem measurements, 64 per cent. showed a negative difference. Although the difference in a given stem can exceptionally equal or even exceed 25 per cent., there is a 51-per-cent. probability that it will not exceed 5 per cent.

[1931]. 52.43.3 (498) : 12.25. TOMA, G. T. Problema tarifelor de cubaj în Romania. [**The problem of volume tables in Rumania.**] *Rev. Pădurilor* 61 (11/12), 1946 (177–87). [Rum.g.]

Up to the present, Rumanian volume tables have been constructed only for Robinia, Spruce and Oak. For other species, Bavarian volume tables are generally used. A detailed comparison is made between Rumanian, Bavarian, and Grundner-Schwappach tables for Spruce.

[1932]. 52.43.3 : 56.04. VIGERUST, A. Kubikk- og tilvekstmasse av smådimensjoner. [**Volume and volume increment of small trees.**] *Tidsskr. Skogbr.* 54 (3), 1947 (123–9). [Nor.]

Gives tables for estimating the volume and volume increment of trees below 10 cm. d.b.h.

[1933]. 52.43.4. STOFFELS, A. De inhoudsbepaling van opstanden door meting van twee modelbomen. [**Determination of stand volume by measurement of two sample trees.**] *Ned. Boschb.-Tijdschr.* 19 (8), 1947 (228–35). [Du.e.]

Cf. *For. Abstr.* 9 (No. 620). Explains a method of Hohenadl's in which two sample trees are selected so as to have basal areas respectively greater and less than the mean basal area by an amount equal to its standard deviation. The mean volume of these two trees, multiplied by the number of trees, is taken as the volume of the stand. If the basal-area distribution is a normal one, procedure may be simplified by using an approximation to the standard deviation.

The method is based on a parabolic relation of the form $V = C_0 + C_1 g + C_2 g^2$, where V = volume, g = basal area and C_0, C_1 and C_2 are constants.

52.46. Strip Surveys

[1934]. 52.46. POPESCU-ZELETIN, I. Procedeul de inventariere cu benzi de probă. [**Methods of making strip surveys.**] *Rev. Pădurilor* 62 (1/3), 1947 (1–10). [Rum.]

[1935]. 52.46 : 01.7 : 52.43.5. LISSDANIELS, O. M. Om provytornas storlek och inbördes avstånd vid linjetaxering. [**The size and spacing of sample plots in strip surveys.**] *Svenska SkogsvFören. Tidskr.* 45 (4), 1947 (217–45). [Sw.e.]

This study, based on data from 36 forests (Scots Pine/Norway Spruce/Birch) in Västmanland, Örebro and Kopparberg, is concerned with:—

(1) The standard deviations of height and volume of the individual diameter classes present in the samples, separately calculated for 3 categories of forest differing in quality class, etc.

(2) The method of calculating, from the standard deviation of volume as found in (1), the number of sample trees required to give a

predetermined standard error for the volume of a whole forest. Consideration is given in this section to two methods of sampling: (i) measurement of all trees above a specified diameter limit on plots of uniform size; and (ii) use of different sizes of plot for the different diameter classes, adjusted so that the number of sample trees for each class is proportional to the product of total volume of the class and its relative standard deviation. Of these methods, it is shown that (i) may require more than twice as many sample trees as (ii). The correlation between required number of sample trees and total area of the forest is also examined.

(3) Distribution of sample trees by diameter classes: In practice the desired distribution for sampling by method (ii) is achieved by adjusting the area of plots, and broad diameter groups are substituted for narrow diameter classes. Three such groups were used in the present study, the middle group being chosen to correspond with the plot area employed in the surveys of the forests concerned. The plot areas appropriate to the upper and lower diameter groups are calculated and converted to 'standard plot areas' by allotting to them values lying somewhat above the average for their class in the majority of the forests.

(4) Distance between standard plot areas: This is calculated by formula, and the relation between spacing and the area of a forest is determined for each of the 3 categories of forest by regression analysis. Results are presented graphically and in tabular form.

(5) Practical procedure: The values given for spacing of plots in a strip assume that the strip width is 10 m., that the distance between strips is governed by principles laid down by J. Östlind (*Svenska Skogsvfören. Tidskr.* 1932) and illustrated graphically in the present paper, and that 3-cm. diameter classes are used. The standard plot areas having been determined for the forests in question as 20, 80 and 200 sq. m. respectively for the diameter groups 8–16, 17–28 and over 29 cm., the practical procedure at a given plot is to measure (*a*) all trees over 8 cm. diam. on a strip section of 2 × 10 m., (*b*) all trees of 17 cm. diam. and over on an adjacent strip section of 6 × 10 m., and (*c*) all trees of 29 cm. diam. and over on a third adjacent strip section of 12 × 10 m.

References are given in the English summary to essential formulae and tables in the Swedish text.

54. FACTORS CONNECTED WITH ASSORTMENT

[1936]. 54 : 52.1. RATAN, I. Aflarea grosimii la capătul subțire al bușteanului din care se fasonează lemn ecarisat. [**Determination of the minimum diameter of log necessary to obtain squared timber of a given dimension.**] *Rev. Pădurilor* 53 (5), 1941 (296–300). [Rum.f.]

56. INCREMENT

See also *For. Abstr.* 9 (No. 1932).

[1937]. 56 : 12.25 : 22.14.2 (786). ROE, A. L. **The growth rate of selectively cut Ponderosa Pine in Western Montana.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 55, 1947. pp. 4.

Report on a study of residual stands of Ponderosa Pine, partially logged between 1906 and 1911 under known marking rules that left an average of 3,810 bd. ft. per acre. A net growth of as much as 126 bd. ft. per acre per year may be expected if a sufficient reserve stand is left.

[1938]. 56 : 12.25 (437) : 55 : 21.9. JAROSLAV, H. O růstu a stáří tisu. [**The growth and age of Yew.**] *Lesn. Práce* 26 (7/9), 1947 (227–54 + 4 plates). [Cz.russ.]

Data on the height, diameter and volume increment and on the age of Yew [*Taxus baccata*] in Czechoslovakia are analysed on the basis of measurements of 9 standing trees and 10 stumps, and comparisons are made with data from other sources. It is noted that Yew does not live as long as is popularly supposed: the oldest tree in Czechoslovakia is about 300 years old, with a girth of 180 cm.

[1939]. 56.02 : 11.21 (410 : 471). HUSTICH, I. **Climatic fluctuations and vegetation growth in Northern Finland during 1890–1939.** With comment by E. W. Jones. *Nature, Lond.* 160 (4066), 1947 (478–9).

Hustich presents a curve showing the annual variations in the diameter increment of Pine near the timberline in the extreme north of Finland, which shows an obvious 'low' period of growth during 1907–16, and a gradually increasing growth for 1920–30. The 'low' period coincided with an absence of seed years. Jones presents two curves representing mean diameter increment of *Quercus sessiliflora*

in the New Forest and volume increment of Silver Fir/Spruce forest in the Swiss Jura for the same period, which display a similar trend. It is suggested that this phenomenon is due to a general rise in temperature from about 1890 to 1930, tempered by the effects of a drought period culminating in 1921. [Cf. *For. Abstr.* 9 (No. 1850).]

[1940]. 56.02 : 11.21 : 12.25. McINTEER, B. B. **Tree ring study in Kentucky.** *Castanea* 12 (2), 1947 (38–45).

A survey was made in the autumn of 1944 to ascertain the relation between periodic rainfall and annual growth of *Pinus echinata* and *P. virginiana*. A close correlation was found to exist between annual growth and amount both of total and of winter rainfall; also between growth and mean temperature March–May, but not mean temperature June–August.

[1941]. 56.02 : 12.25 : 21.8. FRIESNER, R. C., and WALDEN, G. **A five-year dendrometer record in two trees of *Pinus strobus*.** *Repr.* from *Butler Univ. bot. Stud.* 8, 1946 (1–23).

A dendrometer record of all weekly changes in radii, at 4·5 ft. from base, of two trees of *Pinus strobus*, is given for the 5-year period March 1, 1941–March 30, 1946. Time of initiation of true radial enlargement in the two trees ranged from April 15 to May 26. Temperature appears to be the most important factor controlling initiation of radial growth, which always took place within a few days of the establishment of a mean daily temperature above 50° F., and closely followed the beginning of swelling of terminal buds. Rate and amount of weekly radial change were irregular in both trees for all 5 growing seasons. Shrinkages due to dehydration occurred during the normal enlarging season but never lasted more than 2 weeks. During the dormant season, shrinkages and recoveries were numerous and of varying extent and duration. Average annual radial enlargement for the 5-year period was 6·97 mm. in tree A and 6·36 mm. in tree B. Amounts of radial enlargement show a fair degree of correlation with percentages of average annual rainfall. The degree of correlation is greatest when rainfall change is from well above or well below average. Duration of radial enlargement varied, in the two trees and over the 5-year period, from 17 to 28 weeks. It is concluded that *Pinus strobus* is a long-growing species. Cessation of radial enlargement varied in time from the week ending September 18 to that ending November 1. There was no correlation between duration and amount of radial enlargement. *From authors' summary.*

[1942]. 56.2 : 01.7. LONG, H. D. **Short period growth predictions.** *Woodl. Sect. Index Canad. Pulp. Pap. Ass.* No. 921 (F–2), 1947. pp. 5.

The usual methods of predicting stand growth by making separate determinations of diameter and height increment, change in form factor, and mortality and then combining these to arrive at volume increment is unsatisfactory. Owing to the difficulty of measuring height increment, determining form factor, and predicting mortality, large errors are apt to occur in growth estimates, however accurately diameter increment may be determined. It is suggested that research should be directed towards site evaluation and determining the degree of utilization of the site by a stand. This degree determined, it should be possible to predict that for a given site the growth will be so many cords. It is possible that degree of utilization may be found to be correlated with crown cover, in which case growth could be predicted through combination of site studies and analysis of aerial photographs.

57: DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

[1943]. 57 : 12.26–8 (492) : 23.23. TUTEIN NOLTHENIUS, P. M. Gegevens uit de practijk inzake eikeculturen door middel van zaaiing. **[Data from practice on [the growth of] Oak raised from direct sowings.]** *Ned. Boschb.-Tijdschr.* 19 (9), 1947 (241–3). [Du.]

Mensurational data (tabulated) for 11- to 28-year-old stands of Oak [*Quercus robur?*], raised from direct sowings in the Liesbos, show that these stands are so far considerably superior to Schwappach's Quality Class I. The author's experience has been that direct sowing of this species gives results much superior to those of planting.

[1944]. 57.4. STOTT, C. B. **Permanent growth and mortality plots in half the time.** *J. For.* 45 (9), 1947 (669–73).

Describes a simple method of establishing and maintaining permanent sample plots for

measuring growth in commercial timber stands. The author has made a number of improvements in the technique which he expounded in 1939. [Cf. *For. Abstr.* 1 (106).]

[1945]. 57.9 : 12.26–8 (485). CARBONNIER, C. Produktionsöversikter för ask. [**[Provisional] yield tables for Ash.**] *Medd. SkogsforsknInst., Stockh.* 36 (5), 1947. pp. 44. [Sw.e.]

Records in detail the soil, vegetation, treatment, and mensurational data of the 15 individual sample plots studied; discusses the method of assessing quality class; and presents a provisional yield table which allows for two quality classes—I (h_{100} (average height in m. of dominants at 100 years) = 32) and II (h_{100} = 28), having mean annual yields per ha. (1–60 years) of respectively 7·3 and 6·0 cu.m. of stem timber.

Legends of the tables are translated into English.

[1946]. 57.9 : 65.7 : 22.83.2. MULLOY, G. A. **Empirical stand density yield tables. II.** *Silv. Res. Note Dom. For. Serv.* No. 82, 1947. pp. 50 + gphs.

A continuation of the study contained in *Silvicultural Research Note* No. 73 [cf. *For. Abstr.* 7 (No. 1436)]. Percentage composition and stand density are considered in the development of yield curves and tables for one of the principal mixed types in New Brunswick, that of the White Birch/Aspen/Balsam/Spruce type, in which the proportion of hardwoods and softwoods varies from almost pure hardwoods to pure softwoods. It was found that the percentage of volume of the intolerant hardwoods in the stand drops rapidly with age, and that distinct trends in composition development could be indicated by a graph for all ages and densities. The change in stand density with age is rapid when the initial density is low, and more gradual when it is high. This change also can be represented graphically, but the rate of change varies with the composition as measured by percentage volume of hardwoods in the stand. This necessitates allowing for this factor, and four figures have been prepared showing change in density with age for 4 percentage-composition groups. A base curve of volume on age for 100 Stand Density Index was developed from which, by use of the figures mentioned above, the future volume of the stand for any age composition and density can be determined.

During the construction of stand density yield curves for Red and White Pine stands at Petawawa, it was found that apparently the development in density of stands after thinning will follow the same trends with age as would be the case had the stand reached this density naturally. *From author's summary.*

6. MANAGEMENT. WORKING PLANS. SURVEYS

See also *For. Abstr.* 9 (No. 1925).

61. SURVEYING. MAPPING

See also *For. Abstr.* 9 (Nos. 1851, 1958).

[1947]. 61 : 01.7. DRAMBA, D. Notiunea de greutatea măsurătorilor aplicată in operațiunile topografice forestiere curente. [**The application of the concept of weighted average to forest topographical surveys.**] *Rev. Pădurilor* 53 (5), 1941 (265–84). [Rum.f.g.]

[1948]. 61.32. SISAM, J. W. B. **The use of aerial survey in forestry and agriculture.** *Jt. Publ. imp. agric. Bur.* No. 9, 1947. pp. 59 + 67 plates.

This bulletin outlines the economic and technical possibilities of aerial photography in making land-use and vegetational surveys. The account is of a general nature, based mainly on published literature and on reports received from official correspondents of the Imperial Forestry Bureau and the Imperial Bureau of Pastures and Forage Crops. It contains chapters on:—Factors affecting the efficiency and cost of aerial photography; interpretation and application of aerial photographs; the use of air photographs in land-use and vegetation surveys. There are 67 photographic plates a number of which are stereo pairs, and a bibliography of 96 references.

[1949]. 61.32 (485). WELANDER, E. Fotogrammetriens användning i skogsbruket. [**The use of photogrammetry in forestry.**]

Svenska SkogsvFören. Tidskr. 45 (3), 1947 (155–78). [Sw.e.]

After much preliminary experimenting the Swedish National Survey began work in 1937 on the mapping of the country from aerial photographs. The maps in course of production are of two types: (*a*) the 'State map', a mosaic unsupplemented by ground work but provided with names, heights and triangulation points; (*b*) the 'economic map', prepared from the State map with the addition of boundaries, types of buildings, roads, waterways, etc., the details being derived largely from land registers and ground reconnaissance and drawn in with the usual types of conventional mapping signs. The economic map is about 5 times as expensive to produce as the State map. Both types, prepared from original photographs at 1 : 20,000, are on a scale of 1 : 10,000. They are expected to be completed for the whole country in 15 years' time.

The author briefly discusses the methods of preparing these maps and proceeds to deal in a general manner with the use of aerial photographs in forestry, a use as yet very little developed in Sweden, laying particular stress on the need for training in interpretation and the possibilities of aerial photographs in planning for the rationalization of forestry operations. The chief obstacles to more rapid progress at present are shortages of instruments and technicians and the fact that only about 20 days a year are suitable for aerial photography.

[1950]. 61.32. **Opinions on some aspects of aerial surveys.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 916 (A–2–b), 1947. pp. 9. [Committee on Aerial Surveys and Inventories.]

Statements prepared, after a conference at Montreal in December, 1946, by several participants who, at the request of the chairman, undertook to submit their opinions in more detail than was recorded in the minutes. It was concluded that the most important problem in aerial survey of natural resources is the selection of photographic scale. Opinion was unanimous that for the preparation of base maps the scale of 2,640 ft. to the inch (2 in. to the mile) is economical of time and money and is fully adequate for all except special forestry requirements, such as forest types in detail, tree heights, and volume estimates. Industrial foresters seemed prepared to accept the 1,320 ft. scale (4 in. to the mile) as a satisfactory compromise. Non-industrial foresters wanted at least 1,320 ft. and indicated the need of larger scales, e.g. 800 ft. for specific purposes.

Suggestions were made for multi-camera operations at altitudes of 16,000 ft. or higher, which would provide a large sample strip at the desired forestry scale and over-all coverage at the smaller scale required for other services. Another suggestion was for dual photographic operation providing small-scale verticals for mapping and tri-camera photography at the scale required by foresters. The cost of thus satisfying everybody would be no more than that of the present practice of obtaining 1,320 ft. verticals, and appreciable savings of time and money would be effected in mapping.

[1951]. 61.32 (71) : 62 : 07.7. GRAY, D. W. **Experimental use of helicopters on woods development operations.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 923 (A–2–a), 1947. pp. 6.

Report on an experiment in the use of helicopters for reconnaissance, road location and laying out of logging operations in the spring of 1946, in Ontario. It is concluded that the helicopter is an instrument of definite use and value in work of this kind. Information was obtained in 15 hours' flying time which could not have been obtained on the ground in less than 4–6 weeks and which even then would not have been complete. Detail was better than could have been obtained by use of photographs or conventional aircraft. The greatest disadvantage is the very limited carrying capacity; the model used (a Bell Helicopter Model 47) carried only one passenger and no luggage. Amongst special problems dealt with was the gradient of a long steep valley, which was determined by using the hovering ability of the helicopter and a sensitive altimeter. The same method was used successfully in a river survey to determine differences in elevation from point to point in connexion with flotation work. It is suggested that particular attention should be given to the development of techniques for accurately estimating cordage or volume factors.

[1952]. 61.4 : 12.19.2–3 (746). ARNOLD, M. C. **Cover mapping for forest and wildlife management in Connecticut.** *Trans. N. Amer. Wildlife Conf.* No. 11, 1946 (330–8). B.A.P.

Describes the preparation of 2 maps, one of the overwood and the other of undergrowth, for each area surveyed. Gives specimen maps with key to symbols recording percentage of tree species, age classes and density.

63. ROTATION

[1953]. 63 : 12.26–8 (676). **[Rotation of principal timber species.]** *Rep. For. Dep. Uganda 1946*, 1947 (12).

From figures obtained from the Budongo sample plots, the rotation of the three principal species was estimated. Dominant trees of *Khaya anthotheca* were found to require about 125 years to reach the felling limit of 12 ft. g.b.h. and dominant *Cynometra alexandri* and *Maesopsis eminii* about 78 and 55 years respectively to reach the felling limit of 6 ft. g.b.h.; but *Maesopsis* falls off to about half that rate of growth when the pioneer stages which it dominates are invaded by *Khaya*.

[1954]. 63 : 12.26–8. RAM, B. S. **The price-age gradient of Bori (Hoshangabad, C.P.) Teak.** *Indian For. Bull. (n.s.) Silviculture* No. 132 (1942), 1946. pp. iv + 15 + gphs. + plates.

This study was undertaken with the object of determining the most profitable rotation for single Teak trees in the Bori forest on a monetary basis. The analysis of the data recorded shows that the net price per tree varies directly with age; that the price-age gradient of Bori Teak is steep, i.e. larger trees have a much higher value per cu. ft. than the smaller trees; and that the price per cu. ft. continues to rise up to the age of 120 years. The mean annual commercial timber volume and value increments have not yet culminated at 120 years, which indicates that the rotation of highest net income lies somewhere beyond that age.

It is pointed out that this study deals entirely with single trees, and gives no indication of the most profitable crop rotation. *From author's summary.*

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

[1955]. 64 : 12.19.23 (711 : 795 : 797). SPILSBURY, R. H., and SMITH, D. S. **Forest site types of the Pacific Northwest; a preliminary report.** *Tech. Publ. B.C. For. Serv.* No. T.30, 1947. pp. 46.

This paper reports the results of a study of plant indicators, as they pertain to site quality for a part of the Pacific North-west area (Vancouver Island, the Lower Fraser valley in British Columbia and the area west of the Cascade Mountains in Washington and Oregon). It is preceded by a brief review of literature (24 references). The writers believe that this natural system of site classification has definite practical value and that its use will help to improve forest practice.

[1956]. 64 : 12.19.23 (711 : 795 : 797) : 12.25. **[Site quality and vegetation types in the Douglas-Fir region.]** *Rep. B.C. For. Serv. 1946*, 1947 (22–5 + figs.).

Report on studies made in the Douglas Fir types of British Columbia, Washington and Oregon (Coast Forest Climax Formation) in an attempt to adapt Cajander's theory of plant indicators to Pacific North-west conditions. The 5 main plant communities selected as indicators were the *Polystichum*, *P.-Gaultheria*, *G.-Parmelia* and *G.-Usnea*, the composition of these being given in some detail. The height and volume growth of Douglas Fir associated with each of these site types is illustrated by graphs, and it is concluded that the data establish the principle that plant communities do indicate site quality in the Pacific North-west.

A study has been started on the identification of site types in recently logged and burned areas, where the vegetation is greatly modified from that which was originally present under forest cover. The results to date suggest that the ground cover does indicate site quality within a few years after burning.

[1957]. 64 : 12.19.2 : 12.25 (748). BRAMBLE, W. C. **Indicator types for Virginia Pine stands in Central Pennsylvania.** *Res. Pap. Pa. St. For. Sch.* No. 8, 1947. pp. 8.

Two indicator types are described for the Virginia Pine [*Pinus virginiana*] stands in central Pennsylvania. These are the *Cornus florida/Lycopodium* type which includes the better sites having a local site index between 50 and 70, and the *Quercus ilicifolia/Cladonia* type which includes average and poorer than average sites having an index between 30 and 50. Local volume tables have been constructed for the two indicator types and their use is

described. These indicator types have been tested in field work and have proved reliable keys to site quality of Virginia Pine under a wide variety of physiographic conditions. *From author's summary.*

65. DESCRIPTION OF GROWING STOCK

[1958]. 65.7 : 07.7 : 61.32. ROBINSON, M. W. **An instrument to measure forest crown cover.** *For. Chron.*.23 (3), 1947 (222–5). [Dominion Forest Service, Ottawa, Ont.]

It is considered that the degree of crown cover is the most valuable measurable factor, besides height, which can be used in the preparation of forest volume estimates from summer photographs of stands having a high degree of crown cover, or from winter photographs of dense softwood stands, on neither of which is it usually possible to ascertain numbers or details of individual trees. Several methods have been employed in an attempt to collect from sample plots the basic data on crown cover which can be correlated with those derived from air photographs. Ocular estimation was found to be insufficiently accurate. The photo-electric cell was tried as a means of measuring the percentage of crown cover, but proved unsatisfactory because it did not differentiate between a thin crown and small gaps in a dense crown nor could it be used for measuring the percentage of crown cover of hardwoods in winter time. In order to overcome these difficulties an instrument was evolved which, on account of the shape of the pilot model, was called a 'Moosehorn'. It consists of an inverted pyramid about 12·5 in. high and 8·5 in. square at the large end, with a handle at the apex, and an aperture just above the handle; a mirror set in front of the aperture, at 45° to the axis of the pyramid, which permits a view of the complete open end of the pyramid; and a plexiglass top divided into 9 equal squares, each of which contains 25 equally spaced dots.

Two men are needed, one to take the readings and the other to record them. Readings are taken at regular intervals, spaced so that each reading overlaps the preceding one; normally 20 are taken on a $\frac{1}{4}$-acre plot, but 40 are preferable if time permits. The 'Moosehorn' is to be held in a vertical position so that the operator can see the crown cover through the side aperture. Square by square he counts the dots which fall on the open spaces, and calls them out to the tally-man, who records them on prepared sheets. Dots falling on open spaces are used in preference to those falling on tree crowns, because they are more easily distinguished. The crown cover of shrubs or suppressed trees must not be included in the tally, as it is not visible on the air photographs and could not figure in an estimate of density made from them. Computation is made by adding up the number of dots of each square for the 20 or 40 readings and multiplying the results by 0·2 or 0·1 respectively. These figures are subtracted from 100, giving the percentage of crown cover indicated by each square of the 'Moosehorn'. An average of these figures gives the percentage of crown cover for the plot. (It has been found in practice that the results from the central square are seldom very far from the mean of the nine.)

The few plots already measured show a correlation between percentages of crown cover and volume for any one height class. Should further plots prove this relationship to be consistent, the measurement of any plot could be easily converted into figures suitable for the preparation of height/stand-crown-cover tables.

66. POSSIBILITY. SUSTAINED YIELD. YIELD REGULATION

See also *For. Abstr.* 9 (Nos. 1520, 1522).

[1959]. 66 (492). BEVERSLUIS, J. R. Welke kapinkrimping is noodig om de productiecapaciteit van onze bosschen en wegbeplantingen weer op vooroorlogsch peil te brengen? **[What restriction of fellings is necessary in order to restore the yield capacity of our forests and roadside plantings to its pre-war level?]** *Ned. Boschb.-Tijdschr.* 19 (4), 1947 (112–4). [Du.]

It is estimated that for the whole period of the German occupation of Holland (1940–45), excess fellings of timber and firewood totalled 735,000 cu.m. for the conifers and 1,425,000 cu.m. for the hardwoods, or respectively 196 and 723 per cent. of the normal yield. Beversluis suggests that restoration should be made by reducing the annual fellings by 40 per cent. for 5 successive years in the case of the conifers, and by 40 per cent. for 18 years, or 60 per cent. for 12 years, in that of the hardwoods.

7. FOREST ECONOMICS, VALUATION, AND FINANCE

See also *For. Abstr.* 9 (Nos. 1925, 1996).

[1960]. 7 : 02. PETRINI, S. Skogsekonomiens grunder. [**The fundamentals of forest economics.**] Lars Hökerbergs Bokförlag, Stockholm. 1946. pp. 208. [Sw.] [Price 28*s.*]

This textbook is divided into two parts, with main emphasis respectively on general theoretical bases and on practical applications.

Part 1 contains chapters on the peculiarities of forestry, the question of interest, yield studies, increment calculations, calculation of annual yield, stumpage value, costs in forestry, soil value and its alteration with changes in management, the expectation value of stands, and calculations based on the concept of 'normal' forest.

Part 2 has chapters on calculating rotation by various principles, the economics of thinning, maximum costs of a change in management, the economics of regeneration and forest drainage, distribution of costs, calculation of the profitability of a forest enterprise, and forest valuation for various purposes.

76. MANAGEMENT STATISTICS

See also *For. Abstr.* 9 (Nos. 1630, 1637, 1982).

[1961]. 76 : 12.25 (492). Onderzoek naar de kostprijs van hout van de grove den. [**Investigation on the cost price of Scots Pine timber.**] *Ned. Boschb.-Tijdschr.* 19 (10), 1947 (271–88). [Du.] (*Rapport* No. 75 *van het Landbouw-Economisch Instituut*).

Calculations are made of the cost price of Scots Pine timber grown in Dutch plantations, as affected by rate of interest (2½ or 3 per cent.), method of establishment (1- or 2-year-old plants or direct sowing) and three grades of difficulty in site preparation. From the results, which are tabulated, it is concluded that: (1) Rate of interest is the most important factor in the cost price of the timber. (2) At current prices the majority of the plantations will yield no soil rental or entrepreneur's profit and the rate of interest earned will be lower than the ruling per cent. (3) Assuming prices 25 per cent. higher than current ones, only the plantations formed by the cheaper methods would pay in all respects mentioned.

The calculations are presented in detail.

9. FOREST POLICY

[1962]. 9 : 06.2 : 09.4 : 09.7 : 33 : 35 : 98. **Forestry and forest products: world situation 1937–1946.** Food and Agriculture Organization of the United Nations. 1946. pp. 93.

This report consists of three parts: Pt. I, the forestry situation for the major regions of the world (i.e. Europe other than U.S.S.R., Middle East and North Africa, North America, Central and South America, Africa except North Africa, South and East Asia, Pacific area); Pt. II, world balance sheets for the most important forest products; Pt. III, general conclusions and recommendations for national and international action. The following specific recommendations are made for immediate action: (1) FAO should arrange regional forest conferences as soon as possible for Europe, the Far East, and North and South America, with the purpose of drawing up specific programmes to help alleviate immediate wood shortages with a minimum of damage to the forests. (2) FAO should assist and advise governments, acting individually or collectively, in adopting emergency methods to increase production and reduce waste. (3) FAO should call a world conference as soon as possible to agree on definitions and measurement units to be used in FAO's forestry statistics, and to establish clear relationships and conversion factors between national forestry statistics and FAO's standard terms and units. (4) FAO should take immediate steps to establish essential data and balance sheets dealing with the world's forest resources and major forest products. [Cf. *For. Abstr.* 9 (No. 1999).]

[1963]. 9 : 06.2. **Report of the second session of the Conference held at Copenhagen, Denmark, 2–13 September, 1946.** Food and Agriculture Organization of the

United Nations, Washington. 1946. pp. xvii – 70.

Most of the recommendations of the Quebec Conference [cf. *For. Abstr.* 8 (Nos. 781–4)] were endorsed and, subject to minor changes, the report, *Forestry and Forest Products—World Situation 1937–46*, was approved and endorsed.

[1964]. 9 : 06.2 (4) : 90 : 97 : 98. **Report of the International Timber Conference, Marianske Lazne, Czechoslovakia, 28 April–10 May, 1947.** Food and Agriculture Organization of the United Nations, Washington. 1947. pp. 51.

Cf. *For. Abstr.* 9 (No. 1368). The report is divided into three parts: (1) Short-term problems, (2) long-term problems, (3) further procedure, with an appendix consisting of the report of the technical subcommittee on effecting economies in timber consumption. On (1) the conference recommended that during the felling seasons 1947–48 and 1948–49 all [European?] countries should increase their cutting for production of sawn softwoods by 10 per cent., or effect a comparable result by restrictions on use or consumption and that to this end all member nations should give close consideration to the suggestions for economy in the use of timber contained in the above-mentioned appendix, and to controls over housing. On (2) the conference made a number of recommendations, to the effect that all member nations should take measures to ensure management of both public and private forests on a sustained yield basis and undertake reforestation programmes; also that FAO should investigate the possibilities of international control of forest pests, and include forest seeds and plants in an international convention on provenance. It considered that the European countries concerned should meet together from time to time to exchange information and views on their long-term forestry problems and suggested that FAO should consider getting up a consultative committee for this purpose.

The technical subcommittee studied documents on economy in timber utilization presented by the delegations of Austria, Belgium, France, the United Kingdom, and the United States (printed as annexes), and made suggestions for effecting economies in the use of timber (A) in building, (B) in packaging, (C) by substitution of fibreboards, etc., in place of solid timber or plywood, (D) substitution of plywood for solid timber, (E) recovery and re-use of old timber.

[1965]. 9 : 06.2 : 35 : 98. **International Timber Conference, Marianske Lazne, 28 April–10 May, 1947.** *Unasylva* 1 (2), 1947. pp. 44.

A special number devoted to the conference.

90. GENERAL PRINCIPLES OF FOREST POLICY

[1966]. 90 (437) : 09.4. RYCHLY, B. Lesnický dvouletý plán 1947–1948. **[The two-year forestry plan 1947–48.** [With introduction by K. Setínek].] *Lesn. Práce* 26 (4), 1947 (105–35 + map). [Cz.e.] Also reprinted, with a foreword by the Ministry of Agriculture, Prague, under the same title. 1947. pp. 37 + map.

Cf. *For. Abstr.* 8 (p. 460). The pre-war forest area of Czechoslovakia was about 4 million ha., with an annual wood increment of 13·5 million cu.m. Overcutting during the German occupation totalled some 23 million cu.m. and the productive forest area was reduced by 68,000 ha. through neglect of regeneration. The two-year forestry plan for 1946–48, which is part of the general economic plan (envisaged as the beginning of an extensive long-term programme of reconstruction and reform), provides for the felling of not more than 11·1 million cu.m. in 1946–47, the remaining demand to be met by extracting the timber previously felled, which amounts to almost 16 million 'extraction units' [= cu.m. without distinction between over-bark and under-bark measurements?]. Artificial regeneration and afforestation is planned for an area of 32,400 ha. in 1946–47 (to increase to an annual area of 57,000 ha. by 1950–51). Of this, 58 per cent. by area will be planted or sown to conifers and 42 per cent. to hardwoods. To fulfil this programme the total nursery area will have to be extended by 1948–49 by 1,732 ha. The plan also includes the afforestation of 1,500 ha. for soil and water conservation, 205 km. of stream-training operations, and building and mechanization projects to overcome the serious shortage of labour. The programme is summarized in 15 tables.

[1967]. 90 (45) : 11.62.11. QUICK, W. J. **Italy's need for reforestation challenges civilization.** *Food & Agric.* No. 1, 1947 (56–8).

A review, in general terms, of the problems raised by the great and increasing pressure of population on the land, leading to continued use of deforested mountain land, and increasing erosion and flooding. It is urged that it is an international obligation to make it possible, by providing imports of timber and fuel, for the existing woodland and scrub areas to be improved and regenerated, and for mountain areas subject to, or threatened by, erosion to be withdrawn from grazing.

[1968]. 90 (481) : 91.7 : 91.8 : 82 : 09.4. MATHIESEN, J. Mål og midler i norsk skogbruk. [**Objects of Norwegian forestry and means of achieving them.**] *Sak og Samfunn* (*Chr. Michelsens Institut for Videnskap og Åndsfrihet*) No. 10, 1945. pp. 96. [Nor.] John Griegs Forlag, Bergen. Price Kr.2.75.

A semi-popular study on the place of the forest in Norway's national economy and ways and means of increasing its productivity, with special reference to forest labour problems, e.g. provision of work the year round, training and education, and housing.

[1969]. 90 (669) : 92. COLLIER, F. S. **Forest policy and legislation in Nigeria.** Forest Department, Nigeria. 1947. pp. 3. (Fifth British Empire Forestry Conference, Great Britain, 1947.)

[1970]. 90 (712.1) : 09.7 : 12.26–8. **Report of the Saskatchewan Royal Commission on forestry.** King's Printer, Regina. 1947. pp. 150.

Fire prevention and control and the utilization of Aspen [*Populus tremuloides*] are two questions dealt with in some detail. Fires caused in the course of cutting wild hay in forest meadows are a serious consideration. It is estimated that Aspen of some kind is growing on some 15,000 out of the 21,000 sq. miles of accessible forest in the State; volume is estimated at 1,739 million bd. ft. for trees of 10 in. d.b.h. and above on accessible areas. It is suggested that a wallboard industry and increased use of the wood as fuel would help to make efficient use of this large natural resource.

[1971]. 90 (73) : 91.1 : 34.3. WATTS, F. L. **Forests and forest wildlife in the post-war era.** *Trans. N. Amer. Wildlife Conf.* No. 11, 1946 (36–42). B.A.P.

Discusses the American forest situation, the need for increased production, and the Forest Service's programme for (1) public aid to private owners, by advice on forest management and marketing, and help in the production and distribution of planting stock; (2) forest research; (3) expansion and development of national forests; (4) regulation of cutting and other forest practices. Considers the relation of wildlife to the forest, the planned increase of wildlife in understocked areas, the improvement of food and cover conditions, and better use of game resources in view of the mounting demand for hunting and fishing.

[1972]. 90 (801 : 729.5) : 2. WADSWORTH, F. H. **An approach to silviculture in tropical America in Puerto Rico.** *Carib. For.* 8 (4), 1947 (245–68). [E.Span.f.]

A possible silvicultural policy for the management of the forests of tropical America is outlined, and some account given of its application in Puerto Rico. The chief factors influencing policy are (1) the heavy demand for firewood, which means that most trees can be cut while quite small; (2) the necessity of leaving sufficient cover on steep slopes to protect the soil from erosion and from the dominance of lianas; (3) stand structure; if partial cutting is employed, it is important that trees of every diameter class should be left standing and properly distributed. In order to improve the quality of the forests, it is necessary to cut species and individuals having the lowest potential value. In Puerto Rico an attempt has been made to classify species according to their apparent value, and to permit only the inferior species (for which there is nevertheless an effective demand) to be felled.

[1973]. 90 (91) : 8 : 98 : 35 : 07.1 : 07.2 : 91.1. BECKING, J. H. De wederopbouw van den Dienst van het Boschwezen in Indonesië. [**The reconstruction of the Forest Service in Indonesia.**] VOOGD, C. N. A. DE. Natuurbescherming en Boschwezen. [**Nature protection and the Forest Service.**] *Tectona* 36 (3), 1946 (86–161); 37 (3/4), 1947 (88–9). [Du.e.]

Reviews the effects of the Japanese occupation, with tables to show the extent of overcutting, the abnormally large stocks accumulated at timber depots, and the financial results of forestry during the period. Java's forests were the most severely damaged [cf. *For. Abstr.* 8 (No. 1577)] and their productivity for the next 30 years is expected to be about 70 per cent. of the pre-war level. In the remaining islands the Japanese timber industry, though inefficient and poorly equipped, has at least indicated the possibilities of more intensive development.

The major part of the paper is devoted to suggestions for a 10-year plan for concentrating and doubling the productive forest area, raising annual timber production by 1956 from about 2 million to about 5¼ million cu.m., of which 2 million cu.m. would be destined for export, and vigorously developing the timber and wood-using industries, research and education. It is considered that all forest management should be under Governmental control through the Forest Service, which should have separate branches for protection and production forests respectively. The organization and financial structure of such a service, the reconstruction of the timber industry and trade policy, and suggestions on research and education, are examined in detail.

De Voogd argues against control of protection forests and nature reserves by the Forest Service, maintaining that these should be under a special authority. [Cf. *For. Abstr.* 8 (No. 2200).]

[1974]. 90 (91) : 60.31 : 98 : 33 : 34. BEVERSLUIS, A. J. Ontwerp voor een samenstel van boschbedrijfscomplexen als basis voor de boschexploitatie in de Buitengewesten met eenige beschouwingen betreffende vestigingsplaatsen voor de daarmede verbonden industrieen. **[Project for a system of forest management areas as a basis for forest exploitation in Indonesia exclusive of Java, with some considerations on the location of industries using forest products.]** *Tectona* 37 (1/2; 3/4), 1947 (1–27; 71–2). [Du.e.]

It has been widely assumed that, in view of the vast forest areas available, there was little need for safeguarding the yield of Indonesian forests, but close study has shown that comparatively few forest areas exist which are suitable for sustained exploitation. Excluding Java, Indonesia has about 10 million ha. of forest capable of being managed under working plans as permanent production reserves; these could produce annually some 10 million cu.m. of merchantable timber, and also minor forest products, which Beversluis envisages as being eventually produced in regular plantations. It should be the aim to concentrate on timber production from as few species as possible among the soft hardwoods and conifers; these should be easy to grow and economical to exploit. For effective working none of the forest management areas should be smaller than 10,000 ha., and exploitation and the wood-using industries should develop in step with each other. Large investments would be required and the working of the forests would have to be mainly Government-financed. In some of the areas much of the work of reservation, survey and bringing under management has already been done. Draft projects for development, covering a total of 4·7 million ha. with a potential annual timber outturn of 6·6 million cu.m., are discussed and summarized in tables, and conditions determining the location of forest industries are examined. Of the few places suitable in all essentials for industrial development based on forest products, only Singapore and Palembang are at present equipped for their functions. Other places worth consideration are Bandjermasin, Balikpapan, Samarinda, Tarakan, Besitang, Batavia and Surabaya. Porsea in Sumatra and Sampit in S. Borneo are possible sites for pulp industries.

91. SOCIAL AND ECONOMIC INFLUENCE OF THE FOREST. NATIONAL PARKS. RESERVES. FOREST INFLUENCES

[1975]. 91 (786). KAUFMAN, H. F., and KAUFMAN, L. C. **Toward the stabilization and enrichment of a forest community.** U.S. Forest Service, Region One, Missoula, Mont. 1946. pp. viii + 95. [Univ. of Montana, Missoula, Mont.]

Report of a committee formed to investigate the social organization of two typical sawmill towns in Montana and make recommendations for ensuring their economic and social stability. The necessity for managing the forests on a sustained-yield basis is emphasized.

91.1. *Rural Preservation. Reserves. National Parks. Plant and Animal Protection*

See also *For. Abstr.* 9 (Nos. 1473, 1971, 1973).

[1976]. 91.1 (410). SMITH, G. F. H. **Nature protection in Great Britain.** *Nature, Lond.* 160 (4066), 1947 (457–9).

[1977]. 91.1 (410) : 94.11. **National forest park guides: Forest of Dean.** Forestry Commission, London. 1947. pp. 58 + maps.

Includes chapters on the history, geology, vegetation and insects of the Forest of Dean, together with a bibliography and general information for tourists.

[1978]. 91.1 (47). CREȚOIU, P. Protecția naturii în U.R.S.S. **[Nature reserves in U.S.S.R.]** *Rev. Pădurilor* 57 (10/11), 1945 (259–62). [Rum.]

The Soviet Union has created and maintains some 45 nature reserves of area ranging from 10,000 to 1,000,000 ha. and many smaller reserves representing every existing biological type in its territory. The three largest reserves (over 1 million ha. each) are situated respectively in the Kamchatka peninsula, between the rivers Pechora and Ilych (Ural mountains) and in the Sikhote-Alin mountains beyond the River Ussuri. Others are the 600,000-ha. reserve in the Altai mountains, 260,000 ha. in the Caucasus, and 200,000 ha. each around Lake Baikal and in the Kola Peninsula. The Crimean nature reserve includes large stands of *Fagus orientalis* and a local race of that species (*F. taurica*). Many of the smaller reserves are for the purpose of protecting comparatively small colonies of rare plants or animals, e.g. the beaver reserve on the Volga.

[1979]. 91.1 (73) : 60.31.1 : 34.3. FEARNOW, T. C. **Forest wildlife and national forest land management practices.** *Trans. N. Amer. Wildlife Conf.* No. 10, 1945 (104–11). B.A.P.

Notes on co-operation between forestry and wildlife managers in the national forests of the Eastern region of the U.S.A.

[1980]. 91.1 (774) : 60.31.2 : 34.3. HERBERT, P. A. **Observations on the incompatibility of wood and game production.** *Trans. N. Amer. Wildlife Conf.* No. 10, 1945 (119–25). B.A.P.

Good forest management does not always produce game in quantity. The average farm woodland in the Michigan central hardwood belt usually maintains very little game if managed for maximum wood production. Selection cutting gives small and rapidly disappearing openings and therefore an inadequate supply of food plants and shelter to animals. The fringe of undergrowth, being not more than 10 to 20 ft. wide, will only give shelter to wildlife living off the adjacent fields. The practice of leaving one 'den' tree for each 3 to 5 acres decreases wood production by at least 2 per cent. and may cause the scattering of undesirable seed. The Forest Department of Michigan State College made an experimental clear cut of one acre of farm woodland which has provided suitable food cover for wildlife for 10 years. Experiments are now planned in which a rotation of 90 years will be used and one acre out of every 9 will be clear-cut once in 10 years. The practice of maintaining many small openings devoted to food species is preferable where the production of both timber and game is desired. Ploughing bushy sites before tree planting reduces damage from rodents.

91.5. *Value of the Forest for Colonization*

[1981]. 91.5 (714). LUSSIER, O. Le bilan de la colonisation en Abitibi. **[The balance-sheet of colonization in Abitibi.]** *For. québec.* 11; 12 (10; 2; 6; 7), 1946–47 (725–8; 85–8; 405–8; 485–90). [F.]

An analysis of the factors involved in and difficulties in the way of establishing successful forest colonies in Quebec. The need of carefully choosing the colonists, of providing a balanced economy of industry, agriculture and forestry, and of undertaking careful economic, ecological and sociological studies of the area, is emphasized.

93. FOREST RIGHTS, CONCESSIONS AND PRIVILEGES

See also *For. Abstr.* 9 (Nos. 1997–8).

[1982]. 93 : 76. PATRONE, G. La determinazione del prezzo di macchiatico. **[Determination of the price of '*macchiatico*'.]** *Ital. for. mont.* 2 (4), 1947 (208–12). [It.]

'Macchiatico' is the price paid for the right of cutting brushwood, etc., in Italian forests [cf. *For. Abstr.* 9 (No. 1385)]. If M be the total volume of material in the stand in cu.m., m the volume of merchantable assortments derived from M, p the market price of m, and s the cost of converting M into m, then $\frac{p-s}{M}$ represents the price of 'macchiatico' for 1 cu.m. of wood products. The methods of analysing cost are expounded in some detail.

94. FOREST OWNERSHIP. CO-OPERATIVES

[1983]. 94 (729; 88). **Caribbean land tenure symposium.** Caribbean Commission: Committee on Agriculture, Nutrition, Fisheries and Forestry of the Caribbean Research Council, Washington, D.C. 1946. pp. 377 + map. [E.Span.F.Du.]

The Caribbean Land Tenure Symposium was held at Mayagüez, Puerto Rico in August, 1944. The present report consists of the papers read at the conference, together with a summary and analysis in English of the entire symposium. The papers deal with land tenure in the British West Indies, British Guiana, Puerto Rico, Cuba, Dominican Republic, Haiti, Surinam. They are printed in the language in which they were delivered, with summaries in the other official languages of the Caribbean.

[1984]. 94 (73) : 66. MASON, E. G. **These co-operative sustained-yield units.** With comments by I. J. Mason and G. L. Drake. *J. For.* 45 (10), 1947 (735–40).

The writer of the article attacks the timber sales policy of the U.S. Forest Service and the O. & C. Revested Lands Administration (a federal agency). He takes as an example a recent contract entered into by the federal Forest Service with a lumber company in Masar County, Washington, whereby a large area of Government stumpage was combined with the company's lands, which were mostly cut over, to form a single sustained-yield unit capable of supporting the company's big wood-working plants in perpetuity. The policy in general and this contract in particular are defended in comments by the Chief of the Division of Timber Management, U.S. Forest Service, and the Vice-President of the Company concerned.

[1985]. 94 (73) : 66. HORNING, W. H. **The promised land of managed forests.** *J. For.* 45 (10), 1947 (741–5).

The writer urges the usefulness of the co-operative agreements now being entered by the federal authorities, by which private corporative owners of forest land are granted long-term concessions of adjacent public forest land on the condition that the whole area is managed as a single unit on a sustained-yield basis [see previous abstract]. He analyses the past, present, and possible future cut in Linn County, Oregon, in order to show some of the possibilities for beneficial application of co-operative agreements.

[1986]. 94.3 (411–4). GOSLING, A. H. **The forestry dedication scheme.** *Scot. For.* 1 (1/2), 1947 (9–15).

An exposition of the dedication scheme by the Director of Forestry for Scotland, with special reference to Scottish conditions.

[1987]. 94.4 (410). URQUHART, B. **Co-operative forestry in Britain.** *Forestry* 21 (1), 1947 (6–13).

Small scattered units of woodland, a feature of British forests, are of great potential value. The problem of improving the standard of management to raise their yield is discussed, systems developed in other countries are compared, and it is concluded that co-operative forestry societies are the best solution. Those existing in Britain are described and lines of development discussed, with special reference to the Landowners' Co-operative Forestry Society. Recent progress indicates that, as a co-operative society develops, it must devolve part of its work upon regional groups, and their organization is considered. If their progress is to be rapid and assured, some financial aid by the Government is required, similar to that granted by the Danish Government, which pays part of a society's forest officer's salary and expenses. Such a system would be more elastic and workable than an attempt to administer small scattered areas by Government officials and would be less costly than a direct service by the State. *From author's summary.*

[1988]. 94.4 (498). POPESCU, A. C. Asupra administrației și controlului la obștii și composesorate proprietare de păduri. [**The**

administration and control of forest co-operatives and corporate owners of forests.] *Rev. Pădurilor* 53 (10/11), 1947 (535–41). [Rum.f.]

95. FOREST TAXATION

[1989]. 95.1 (421–9). HART, C. E. **Taxation of woodlands.** *Quart. J. For.* 41 (2), 1947 (70–2).

Brings up to date a previous article by the same author on the taxation of woodlands in England [cf. *For. Abstr.* 6 (270)].

96. POLICY REGARDING PROTECTION FOREST, DEFORESTATION AND AFFORESTATION

[1990]. 96.3 (66 : 67). AUBRÉVILLE, A. M. A. **The disappearance of the tropical forests of Africa.** *Unasylva* 1 (1), 1947 (5–11). [E.]

The author deals with forest regression in tropical Africa as a whole, making a distinction between that of the equatorial high forest, which is steadily, though slowly, taking place as a result of encroachments of native cultivation at its edges, and that of the tropical dry forest which to-day survives only in comparatively small remnants, and has elsewhere given place to the typical African landscape of wooded savanna. This wooded savanna is artificial except in the desert borderland areas, and has come into existence from the effects of fire and clearings on the original, close-canopied high forest with shrubby understorey but no grass undergrowth. The consequences of deforestation in respect of timber production, living conditions, precipitation, and climate are outlined.

[1991]. 96.3 (81) : 11.62. ARRUDÃO, M. Fim das florestas de S. Paulo. [**Destruction of the S. Paulo forests.**] *Brasil madeireiro* 3 (26), 1947 (6–7). [Port.]

A short summary of the causes and results of deforestation in São Paulo, Brazil. To preserve the water-regime equilibrium, forests should cover 20–30 per cent. of the total land area. Forests now cover only about 12 per cent. of S. Paulo, 14 per cent. of Pernambuco, 30 per cent. of Paraiba and 0·1 per cent. of Sergipe. Droughts are increasing in S. Paulo to such an extent that its climate can no longer be classified as 'temperate-rainy'. One of the chief agents in the over-exploitation of the forests is the railway company which has despoiled them for fuel without introducing adequate reforestation measures. Figures illustrating the extent of the devastation are given.

[1992]. 96.5 (46) : 91.5. GOMEZ PEDRAZA, C. Labor forestal en la colonización des grandes zonas. [**Forestry in the resettlement of large areas.**] *Montes, Madrid* 3 (15), 1947 (252–5). [Span.]

A general article showing how forestry plays an important part in the resettlement and cultivation of large areas declared of national interest by the Spanish National Resettlement Institute. Two such State-aided areas in the Ebro valley are cited as examples. They are almost completely devoid of tree vegetation and show regressive characteristics very far from the climax corresponding to the ecological conditions. Here large-scale afforestation has been undertaken and suitable types of tree have also been planted to stabilize slopes in catchment areas, as roadside avenues, for amenity and shelter of villages and to assist in the drainage and improvement of saline soils.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

See also *For. Abstr.* 9 (Nos. 1539, 1558).

[1993]. 97.1 (410). STAMP, L. D. **The land of Britain and how it is used.** Published for the British Council by Longmans, Green & Co., London. 1946. pp. x + 80 + plates + map. Price 2*s.* 6*d.*

Describes the changes which have taken place in the British countryside and its economy during the centuries and the methods by which the output of food was increased during the war. Concludes by discussing the problems of the future and suggesting some solutions.

[1994]. 97.1 (481). Innstilling fra Utmarkskomitéen oppnevnt av Det Norske Skogselskap 12 Desember 1939. [**Report of the Committee on Unenclosed Lands appointed by the Norwegian Forestry Society on Dec. 12, 1939.**] Grøndahl and Søns Boktrykkeri, Oslo. 1945. pp. 217. [Nor.] Price Kr. 3.75.

Reports in detail on the present condition and utilization of, and recommends a future policy for, the unenclosed lands of Norway, which cannot be efficiently used—whether for agriculture, pastoral interests or forestry—without

proper cultivation. The chief proposals are for more rapid dissolution of common ownership and injurious rights, stronger central supervision of colonization, adjustments in regulations affecting credits for purchasing supplementary land; proper regulation of grazing and the establishment of cultivated pastures, improvement of grazing above the timberline; measures (especially by the State) to promote forest regeneration in the coniferous zone and afforestation of much open land below the timberline; improvement of freshwater fisheries, the compilation of a proper land register and the establishment of local boards to supervise development.

[1995]. 97.1 (564.3) : 06.2. **The proceedings of a conference on land use in a Mediterranean environment, held in Nicosia, Cyprus, 16th–17th April, 1946.** Govt. Printing Office, Nicosia. 1947. pp. 50+maps.

This conference was sponsored by the Cyprus Government and attended by officers of the Agriculture, Forest, Irrigation, Land Registration and Survey, and Co-operation Departments of the Government of Cyprus, representatives of the Greek and Turkish farmers' unions of Cyprus, and delegates from Palestine. The following papers, together with discussions on them, are here reprinted:— Land use in relation to climate and topography, by J. Macdonald, Director of Agriculture; The state forests: their rôle in the island's land-use policy, by R. R. Waterer, Conservator of Forests; Water supply in Cyprus: some aspects of water control, by A. Cawley; Malaria in Cyprus, by M. Aziz, Chief Sanitary Inspector; The tenure and inheritance of immovable property in Cyprus, by P. Christodoulou; Forest grazing: the problem and its care, by G. Chapman, Ass. Conservator of Forests; The development of co-operation in Cyprus, by R. N. Henry; The farmers' point of view, by the Pancyprian Farmers Association; Soil fertility in the arable areas of Cyprus in relation to land use, by L. Littlejohn; Trees and their part in village land use and development, by T. Couppis, Ass. Conservator of Forests; Animal husbandry in relation to land use and environment, by J. Maule.

[1996]. 97.3 (411–4) : 7. Zeissl, S. **The relation between forestry and hill sheep farming.** *Scot. Agric.* 27 (2), 1947 (95–8). O.R.E.

A comparison is drawn between forestry and hill sheep farming in Scotland in order to assess their relative contributions to the national economy. Annual receipts from hill sheep farming, including subsidies, averaged about £1 per 'plantable acre' on some of the larger lowland farms. The corresponding forestry production may be estimated at £3 to £6 according to the species and quality. If yields are compared in percentage of invested capital, higher figures are obtained for hill sheep farming, i.e. 9–14 per cent., as compared with 3–6 per cent. for forestry. This higher yield is due to substantial subsidies and grants. On the other hand, the much smaller capital investment and the special risks involved in sheep farming make it necessary to assume a higher rate of compound interest. The writer has calculated 3½ per cent. for hill sheep farming but only 2½ per cent. for forestry. A comparison of land values per acre for the two industries shows that 1 acre of land which can produce reasonably good timber is worth, under present conditions, 2 to 4 times as much for forestry as for hill sheep farming. Forestry employs on an average 5 times as many workers per acre as hill sheep farming, hence its importance in the resettlement of population in rural areas, where, the author suggests, both industries could be developed advantageously side by side.

[1997]. 97.3 (481) : 93. Opsahl, W. Om avløsning av beite i skog. [**The dissolution of forest grazing rights.**] *Tidsskr. Skogbr.* 53 (1/2), 1945 (1–12). [Nor.]

Discusses the legal problem of grazing rights in the forest, and the possibilities of solution by providing other land for grazing within the limits of the existing law.

[1998]. 97.3 (481) : 93. Voss, P. W. Kan en skogeier ved inngjerding eller på annen måte verne sin skog mot skadelig beiting? [**Can a forest owner protect his woodland against harmful grazing by fencing or other means?**] *Tidsskr. Skogbr.* 53 (5/6), 1945 (88–91). [Nor.]

A discussion of the problems resulting from the traditional grazing rights and grazing laws in Norway.

98. THE TIMBER MARKET

[1999]. 98 : 2. **The growth of the world's forests.** *Unasylva* 1 (1), 1947 (27–36).

Cf. *For. Abstr.* 9 (No. 1962).

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References: 1. *Action forestier*, Paris. 2. *American Nurseryman*, Chicago. 3. *Annual Report New Zealand Forest Service*, Wellington, N.Z. 4. *British Columbia Lumberman*, Vancouver, B.C. 5. *Countryman*, Burford, Eng. 6. *Crown Colonist*, London. 7. *Foreign Commerce Weekly*, Washington. 8. *Forestry Commission Leaflet*, London. 9. *Journal of the Land Agents' Society*, London. 10. *M.L.B. Log*, Amherst, N.S. 11. *Mundo maderero*, Buenos Aires. 12. *Nature*, London. 13. *Pulp and Paper Magazine of Canada*, Gardenvale, Quebec. 14. *Skogen*, Stockholm. 15. *Southern Forestry Notes*, New Orleans. 16. *Southern Lumberman*, Nashville, Tenn. 17. *Spectator*, London. 18. *Technical Notes, Forestry Commission, N.S.W.*, Sydney. 19. *Timber of Canada*, Ottawa. 20. *Timber Trades Journal*, London. 21. *Timberman*, Portland, Ore. 22. *West Coast Lumberman*, Seattle, Washington. 23. *Wood*, London.

The numbers in brackets indicate the reference number and date of publication of the periodicals, etc., to which the annotations refer.

Australia. It now appears that, instead of waiting 7 or 8 years for the earliest fruit production, the interval after planting Olives may be greatly reduced. This extremely desirable innovation is said to be due to a chemical process evolved by a plant breeder in California. It is claimed that, as a result of this invention, young trees come into bearing in a comparatively short time, and that this has been demonstrated by practical tests in Australia, where a grower in Victoria has secured the rights to use the system. Rooting and subsequent development of the slips has been speeded up remarkably, and the method is so successful that within 3 years of planting 12-in. slips of year-old wood, the trees have attained 14 ft. in height, evidently with proportionate lateral development. It is now claimed that Australia, which already grows Olives, will be quite independent of imported Olive oil in less than 3 years. The Victorian producer is said to be planning to propagate 300,000 trees in 500-acre groves. It is reported that the method is also effective with Tung, Apricots and Apples (**6**; Dec. 1947).

Investigations into the tanning properties of White Cypress Pine (*Callitris glauca*) bark at the Sydney Technical College have shown that it produces leather of a better colour than does Black Cypress Pine (*C. calcarata*), though it has a lower tannin content. The White Pine extract can be substituted for a considerable percentage of Wattle bark usually used for sole leather [cf. *For. Abstr.* 8 (p. 459)]. (**18**; March 1947.)

Production of vegetable tanning material in Australia has steadily declined in recent years owing to shortage of labour and the relatively low cost of imported tanstuffs. Producers, however, are assured a market for their entire output, as the importation of Wattle or Mimosa bark and extract is permitted free of duty only so long as tanners continue to purchase as much as Australia's bark mills and extract plants can produce (**7**; 25.10.47).

Borneo. Plans have been made by a Dutch company to establish an important timber industry in Borneo. It has been granted forest concessions, and the exploitation of indigenous softwoods is expected to form a large part of its activities. An initial sum of about $2,095,000 is to be invested in a large sawmill with a productive capacity of about 120,000 cu.m. annually. An agreement has already been made whereby the lumber company will supply the Borneo Department of Public Works and Waterways with 20,000 cu.m. of timber annually for a period of 5 years. A cellulose factory is also planned (**7**; 4.10.47).

Brazil. By a decree of 11th March, 1947, more than 17½ million ha. of land in Rio Grande do Sul has been declared forest reserve. The land in question is virgin forest lying along the R. Uruguay, between the rivers Turvo and Pari. The over-exploitation of forests in this State, which has reduced the forest area from 20 per cent. to only 7 per cent. of the total area, has made reservation advisable (**11**; Aug. 1947).

Burma. The Burmese Government is to nationalize the forest industry, and replace British forest lessees with Burmese over a period of 10 years (**20**; 6.12.47).

Canada. The technical branches of the Department of Mines and Resources are to be completely reorganized; the branches of Mines and Geology, Land, Parks and Forests, and Surveys and Engineering are to be abolished, and their place taken by two new branches. One of these, to be known as the Mines, Forests and Scientific Services Branch, is designed to include all the basic research activities of the Department as well as the topographical, geodetic, hydrographic and legal surveys and all departmental activities in the way of map computation and reproduction, which have hitherto been distributed among 3 branches and 6 buildings. Plans are under way to concentrate all survey and mapping activities in a single building. The second branch will be known as the Lands and Development Services Branch and will be responsible for applying the results of research carried out by the other branch; it will also handle engineering and constructional work. It is expected that, in addition, to increasing the efficiency of the Department, this reorganization will effect an immediate saving of $80,000 per annum, and ultimately of a much larger sum (**4**; Nov. 1947).

A device which would spot forest fires and report their location by radio is being tested at the University of Toronto. The basis of the device is a 'bolometer', which scans the landscape through an optical system. It revolves, and detects fire through heat, and then gives an alarm by radio. The equipment is shortly to undergo field tests (**13**; Nov. 1947).

The Forest Insect Department of the Federal Government is operating a 60-ft. vessel, equipped as a floating laboratory, along the British Columbia coast. Five of her crew of 7 are qualified entomologists, and they will be continually on the lookout for destructive insects found in timber stands of the coastline (**13**; Oct. 1947).

After causing heavy loss, the Hemlock looper is definitely on the wane in British Columbia. Damage on Vancouver Island alone runs into hundreds of millions of board feet. The problem now is, how much of the damaged timber can be salvaged. Field crews are trying to determine measures to deal with this. It will be necessary to go into some of the most inaccessible areas first, if the vast tract of dead timber is to be salvaged (**13**; Oct. 1947).

The Forests Products Laboratories at Ottawa have built an arch of glued, laminated timbers with a 47-ft. span and a 21-ft. rise, manufactured throughout of White Spruce and casein glue, and are at present subjecting it to a total design load of 27,920 lb. plus an overload of 20,680 lb. It is planned to study the behaviour of the arch under overload for several months. The arch is intended to serve as the roof-support of a proposed building. It is now carrying a load of 48,600 lb. The deflection of the crown hinge to date is less than 3 in. (**19**; Dec. 1947).

A New Brunswick company is now manufacturing barrel staves of laminated White Oak and New Brunswick Birch. When assembled and held together by steel hoops, the laminated barrels weigh 72–80 lb. each (**19**; Dec. 1947).

France. The Poplar planting programme is in full swing and, during 1947, 10,000 landowners obtained subsidies from the national forestry fund for the purpose of planting. Loans can be obtained at a rate of ¼ per cent. repayable in 50 years, which is very advantageous to planters. The Poplar Committee proposes to set up a Populetum at Vineuil near Blois in the Loire valley. The Committee gives two general pieces of advice to intending planters:—(1) never to plant trees coming from a region infested with canker; (2) to plant nothing but *Populus robusta* in infested areas (**1**; Dec. 1947).

Germany. Some interesting results were obtained by Dr. Baesder, a German technologist, during his efforts to find a way of improving the wearing qualities of railway ties. The first tie produced consisted of a hardwood bearing plate glued to the top surface of a softwood tie. From this was developed the idea of using a wood plate of sufficient strength in compression to make the use of the steel bearing plate normally placed between the rail and the tie unnecessary. By impregnating plywood plates with preservative materials according to the Nowack process, a bearing plate was produced which, under actual conditions, unaided by steel plates, was capable of taking the compression load satisfactorily. In the opinion of Dr. Baesder, the glued tie could be expected to have a longer life than the conventional type, since the action of the steel bearing plate in crushing and grinding the top surface of the tie is eliminated. Also, whereas the movable steel plate tended to cause moisture to accumulate between the tie and the bearing plate and so encouraged decay,

the bonded plate and tie are quite free from this danger. Tests on the glued ties were carried out in Germany on only a very limited scale (**23**; Jan. 1948).

Great Britain. The recommendation of the Tree of Heaven [*Ailanthus glandulosa*] as an alternative to the London Plane for street planting, has aroused some well documented criticism. There was a glorious specimen in a private garden in Golders Green which became notorious. It heaved the pavement in the adjoining street, interfered with drains, and was finally uprooted by the authorities of the garden suburb; yet even after that, suckers sprang up in numbers and still continue irrepressible. The avenue of Trees of Heaven in Meadway, Golders Green, should be critically watched by those who decorate London streets (**17**; 7.11.47).

The Willows growing along a stream in Hampshire were about 30 ft. high and had never been pollarded. One winter, two growing next to each other were blown down: some of their roots were in the air and some still under water. A few weeks later it was decided to cut them up for firewood, when it was found that both had resumed their original upright position. Three years later the same thing happened again; this time one had actually been chopped up when both its stump and the other tree were found erect again [cf. *For. Abstr.* 7 (p. 587)] (**5**; Winter, 1947).

At the request of the Forestry Commission, the Council of Management of the Macaulay Institute for Soil Research, Craigie Buckler, Aberdeen, has agreed to train a specialist in forest soils. He will investigate the physico-chemical relationship of soils on which canopy is being formed (**23**; Dec. 1947).

The forest fire at Wareham, Dorset, was the worst to occur in State woodlands for more than 5 years, and caused damage amounting to £11,500. The fire, which spread to Commission plantations from adjoining land, burned for several days, and 246 acres of Pine trees were destroyed. There were altogether 701 outbreaks of fire in Forestry Commission woodlands during the year ending 30th September, 1947, which caused damage amounting to £26,000, the planted area burnt being 855 acres. The exceptional weather had much to do with this, for the loss was much higher than in most recent years. For instance, in the forest year 1945, it was only £5,000 (**8**; 3.11.47).

In the neighbourhood of Hertford, woodpeckers have adopted the habit of boring holes in the wooden poles of overhead transmission lines, and inflict considerable damage. The poles are impregnated with creosote, which disposes of the theory that the woodpeckers are seeking insects. It seems to be established that the older poles are always selected, though the birds will return again and again to the same place, even when a fresh pole has been substituted for a damaged one. No preventive has yet been found. The green woodpecker is the chief, but not the only offender (**17**; 7.11.47).

It is estimated that 90,000 poles per annum from home sources will be required during the next 2 or 3 years in order to bring electricity supplies to farms. The poles required are 28–36 ft. long, with butt diameter 7–9 in. and top diameter 5–6 in., of any species of conifer. The supply authorities will consider parcels of as few as a dozen poles from any one estate. Every effort will be made to ensure that poles felled under this scheme will be used only for supplies to farms and cottages (**9**; Dec. 1947).

The Minister of Agriculture, in a parliamentary reply, recently stated that Poplar plantations (e.g. for match stock), if properly made and stocked, would qualify for grants under the Forestry Commission's dedication scheme (**9**; Dec. 1947).

A new laminated material 'Vendura', is being manufactured by Venesta, Ltd. It consists of an aluminium sheet with wood veneer cemented on one or both sides. The adhesion of the wood to the metal is claimed to be exceptionally good, and the material is capable of standing up to very severe conditions. It is also said to be fire-resistant; it can be glued like wood and rivetted like metal and it is available veneered with various woods. It should be specially useful where curved wood surfaces are required, as it will bend to very small radii without difficulty (**20**; 15.11.47).

A German refugee scientist, Edmund Herrman, now living in London, claims to have invented a new kind of wood which can be made in an hour and is being marketed by several British firms. The new material is called 'soil wood' and is the result of bacterial action on soil. It looks very like natural wood, but has no grain, is less elastic, and much heavier and harder than most woods. It is waterproof and fire-resistant, can be planed, sawn, cut, nailed and shaped like natural wood and has the added advantage that it can be made in any shape required. The new wood can be dehydrated

at 200° F., and exported in powder form. A separate company, Export Wares (Manufacturing) Co., Ltd., is responsible for this side of the work. The powder can be turned into wood within an hour by the simple addition of water. It is estimated that the four existing companies can manufacture 50,000 tons a year. The inventor has not patented his discovery because, he says, scientists from all over the world have been unable to find the secret of its production by analysing the manufactured article (**4**; Nov. 1947).

Welsh farmers are fighting forestry proposals, and a deputation met the Parliamentary Committee of the N.F.U., and later the Minister of Agriculture, to submit their case against the afforestation programme. Three points were emphasized as vital if Wales was to fulfil its programme of food production:—(1) No trees must be planted on new lands until all cut-over woodlands are replanted. (2) Acquisition of new land for afforestation must be resorted to only after full consultation with the country agricultural executive committees in Wales. (3) Every notice to quit now in operation to provide for afforestation instead of agriculture, should be cancelled (**20**; 15.11.47).

Hawaii. The Government has recently begun sawmill operations on the island of Hawaii. The principal species are Koa [*Acacia koa*] and Ohia [*Metrosideros collina*], both much valued for cabinet work and flooring. A minor forest industry of some importance is the gathering of trunks of tree ferns, which are highly prized by orchid growers, who use the material as soil for orchid culture (**21**; Nov. 1947).

Italy. A nurseryman at Bologna, 14 years ago, obtained 100,000 seedlings of Chinese Elm from America, with the intention of introducing them for vine supports in place of the common Elm which at that time was beginning to suffer from Dutch Elm disease. The seedlings grew very rapidly, but it was found that the habit of the species was unsuited to use in vineyards, the crown being too dense and the branchlets too weeping. They have since been used for street planting and a suitable Elm for use in vineyards has been obtained by grafting the Christine Buisman hybrid on Chinese Elm stock (**2**; 1.12.47).

Japan. Japan has been cutting, on the average, twice the amount of estimated annual growth during the past few years, but the overcutting has been concentrated in the accessible areas. Current data indicate that there are 6½ million acres of inaccessible forest, largely in Honshu, containing more than 14,000 million cu. ft. of timber, of which 10,000 million are hardwoods. Much timber is being lost through mortality and decay in overmature stands and reduction in annual growth through overcrowding. The Japanese Bureau of Forestry plans to construct 1,200 miles of roads and to improve streams, in order to open up this forest area (**7**; 29.11.47).

New Zealand. A start has been made on a programme for the investigation of all fungi associated with each tree species, the Silver Beech [*Nothofagus menziesii*] being selected for initial study. The recognition of over 40 fungi, many not hitherto recorded in New Zealand, and of which two at least are undescribed, marks the beginning of a new phase in forest mycology as related to silviculture. The parasite *Cyttaria gunnii* was studied, together with two new and undescribed species of *Cyttaria*. Twelve species of the genera *Fomes*, *Polyporus*, and *Poria* were found to cause heart rot in living Silver Beech (**3**; 1947).

Nigeria. A small botanical expedition under the leadership of Dr. P. W. Richards (Botany School, Cambridge) left England on November 15th, 1947, for Nigeria, to work in the field until the beginning of April, 1948. The chief object of the expedition is to investigate the process of natural regeneration in the evergreen tropical forest, with special reference to Aubréville's 'Mosaic Theory'. It is expected that the greater part of the work will be carried out in the forest reserves of Benin Province; but if circumstances permit, some members of the party will visit the Cameroons and make an ecological study of the little known montane forests. The expedition has the financial support of the Royal Society and of the Colonial Research Fund (**12**; 6.12.47).

Norway. Special efforts are being made to increase the log felling in Norway during the coming winter to 8 million cu.m., compared with last winter's output of 6 million. Log prices have been increased by Krs. 4 per cu.m., and in order to induce the forest labourers to go back to felling and transport work in the forests, their wages have been considerably raised, in addition to which various kinds of social advantages have been offered to them. It is reported that about 25,000 men are now at work in the forests and that this figure will increase. The Government has decided that the output of logs shall be divided between the timber industry for conversion into timber, and the paper and pulp industry ($3\frac{1}{2}$ million cu.m. each). Any surplus quantity of logs above 7 million cu.m. and up to 1 million cu.m. is to be allocated to the timber industry for the special purpose of conversion into timber, preferably planed boards and boxboards, for export (**20**; 6.12.47).

South Africa. It is claimed that a new process for treating Wattle bark cuts down to 6 days the tanning time which, with pure Wattle, has hitherto been 3–12 months. One of the larger South African tanneries has been producing half its output by this method for the last 8 months, and it has proved so satisfactory that it is now going to be used for the total production (**6**; Nov. 1947).

Professor R. W. Willcox of the University of Stellenbosch stated recently that the Gold Producers' Committee of the Transvaal Chamber of Mines had decided to endow the University of Stellenbosch with £2,000 a year to establish a chair of timber technology. The aim of the endowment is to further research into industrial uses of wood. This new department, to be established as soon as possible, will fall under the Faculty of Forestry. It is hoped that the chair will be filled before the beginning of the next academic year (**20**; 6.12.47).

Surinam. Construction of a large modern plywood factory was planned to begin in October 1946 on the Surinam River. Cutting of timber will begin along the Surinam Government Railway, where the plywood manufacturing company owns large tracts of forest. Logs will be stored in a basin 12 ft. deep, connected with the river by a short canal (**16**; 15.12.47).

Sweden. At the Institute of Structural Engineering, Gothenburg, dielectric heating has been applied to bonding wood waste in the manufacture of building board. Shavings and sawdust are mixed with a binder of synthetic resin glue in a liquid state. The chips are then sieved and the binder is evenly spread over them. Then, according to the specific gravity required for the finished board, and while still under pressure, heat is applied by a high-frequency generator, and the binder acts in a matter of seconds. It is claimed that both light-weight and heavier boards of good quality can be produced by this method and at a cost lower than that of the usual method of manufacturing building board (**23**; Dec. 1947).

A Swedish firm has been demonstrating what it calls the 'peace jeep', with various alternative attachments including a rear driving wheel for belt-driven accessories (e.g. small crosscut benches for firewood), an air compressor for pneumatic tools, a fire pump, and a plough that works in front of the jeep but is actually attached to the rear of the vehicle, which therefore pulls rather than pushes the implement (**14**; 1.12.47).

It is considered to be in the public interest to favour the cellulose industry in the supply of raw materials. The cutting of pitprops has been completely stopped in large areas of Sweden and reduced to a minimum in others, in favour of pulpwood cutting. The restrictions are superfluous in some cases, as pulpwood prices have risen so much that pitprops are competing only in areas remote from pulpmills (**10**; Nov. 1947).

U.S.A. Development of a superior strain of Slash Pine [*Pinus caribaea*] for the naval stores industry is being attempted at the Lake City branch of the Southwestern Forest Experiment Station, both by artificial pollination of élite trees and by vegetative propagation of such trees or of crosses between élite individuals. It has been found that the best rooting is obtained from cuttings taken in the autumn. Five or six in. of current year's growth at the end of a twig roots best, no old wood being taken (**22**; Nov. 1947).

A noteworthy feature of the successful campaign for control of the tussock moth in northern Idaho, was that it was promoted and financed jointly by federal, state, and private forest owners.

The U.S. Government bore all expenses on natural forest and other federal lands, the State of Idaho on state lands, and private owners one-quarter of the expense on their own lands. The remainder of the cost of control on private lands was borne as to one-quarter by the state and one-half by the federal government. The Forest Products Laboratory, Coeur d'Alene, Idaho, a branch of the U.S. Bureau of Entomology, charted the epidemic and recommended suppression measures, and the U.S. Forest Service lent administrative and technical staff to help carry them out. Congress has now passed an act legalizing federal co-operation with state and other landowners for control of forest insects (**22**; Nov. 1947).

Development of a powerful new insecticide, known as 'thiophos 3422', described by a company spokesman as 'five to twenty-five times as potent as DDT', has been announced by the American Cyanamid Co. Dr. Bruce D. Gleissner, research entomologist, said that the degree of potency of the new compound over DDT depends on the type of insect it is used against, but that it is the most uniformly toxic compound yet developed and has a wider range of effectiveness than any other chemical now in practical use (**2**; 1.1.48).

The American Association of Nurserymen has announced that it is now ready to engage in the registration of all new woody plants, exclusive of fruits and roses (already registered by other organizations). It is hoped to compile and maintain a complete file for each new woody plant originating in, or introduced into the U.S.A. since and including 1930, to continue such records, and to make them freely available (**2**; 1.1.48).

Wild pig are one of the worst enemies of young Longleaf Pine seedlings, the roots of which they strip of bark. A sow was seen to strip 15 ft. of root in 10–12 minutes. One pig can destroy 400 young Pines in a single day. One was timed uprooting and feeding on Longleaf seedlings in the grass stage at the rate of 6 a minute (**15**; July, 1947).

The U.S. Forest Service has undertaken operations to salvage some 8 million bd. ft. of sawtimber and 6,000 cords of pulpwood killed in last October's forest fire in the Massabesic Experimental Forest, Maine. Sowing of the most severely burned sections with White and Red Pine seed from aeroplanes will be completed early in 1948. Nursery-grown seedlings will also be planted out for comparison of cost and efficiency (**16**; 15.12.47).

In an experiment at the Southern Forest Experiment Station, molasses made from slabs of mixed species of Southern Oak was mixed with cottonseed cake and fed to cows, which ate it even when range forage was good. The molasses was made at the Forest Products Laboratory at Madison; tests of its food value are under way there and at the Mississippi State Experiment Station at Statesville. Test runs at the Laboratory indicated that for a modest investment, molasses can be manufactured at a low cost. A plant with a capacity of 25 cords of wood per day can produce about a tank-car of molasses daily. Cull hardwoods are occupying an ever-increasing portion of the southern forests, and the use of these trees for molasses would not only dispose of them at a profit, but would also give the southern livestock industry a badly needed source of cheap carbohydrates (**15**; Sept. 1947).

In the University of Washington there is a plywood basketball court 10 years old and still in service. The $\frac{3}{4}$-inch panels of exterior-type Douglas Fir plywood were originally laid to replace other flooring which failed after a short time owing to severe moisture conditions. Not only has the plywood proved its durability, but it also provides an exceptionally resistant playing surface. Use of the panels, moreover, greatly simplifies the work of laying the floor each autumn and taking it up in the spring (**20**; 20.12.47).

A new forest industry which has developed in Alabama and the adjoining states since 1937 is the production of storax, the fragrant gum which exudes from the bark of the Sweet Gum (*Liquidambar styraciflua*), and which is used in medicine and pharmaceutical preparations. Before 1937, storax was imported from China and Asia Minor. The method of collection is much the same as resin tapping of Pines, except that the gum has to be scraped off the trees. Each tree produces from one-half to one pound of gum each year for 3–5 years, and one man can operate 1,500–2,000 trees a year (**16**; 15.12.47).

New York State College of Forestry at Syracuse University is the first forestry school in the country to inaugurate a course on 'human relations in forestry'. During this course, which is for seniors and graduate students, lectures will be given by economists, specialists in public relations, and foresters (**19**; Nov. 1947).